Miss Sarah W. Livermore

EXTRA

NEW-YORK TRIBUNE.

USEFUL WORKS FOR THE PEOPLE....NO. VI.

THE SILK CULTURE:

WITH

HISTORICAL SKETCHES OF THE SILK BUSINESS

IN

EUROPE AND THE UNITED STATES;

THE NATURAL HISTORY OF THE SILK-WORM,

MULBERRY TREE, &c.

WITH NUMEROUS ENGRAVINGS.

NEW-YORK:
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1841.

PRICE TWENTY-FIVE CENTS.

THE

SILK CULTURE

IN THE

UNITED STATES:

EMBRACING

COMPLETE ACCOUNTS OF THE LATEST AND MOST APPROVED MODES OF

HATCHING, REARING AND FEEDING THE SILK-WORM,
MANAGING A COCOONERY, REELING, SPINNING,
AND MANUFACTURING THE SILK, &c. &c. &c.

WITH

BRIEF HISTORICAL SKETCHES OF THE SILK BUSINESS,
NATURAL HISTORY OF THE SILK-WORM, THE MULBERRY, &c.

COMPILED FROM THE MOST APPROVED AND RELIABLE WORKS,

ILLUSTRATED BY

NUMEROUS ENGRAVINGS OF MACHINERY AND PROCESSES.

TO WHICH IS ADDED

BLYDENBURGH'S MANUAL OF THE SILK CULTURE;

STATISTICS OF SILK IMPORTS, &c. &c.

NEW-YORK:
GREELEY & McELRATH, TRIBUNE OFFICE,
160 Nassau-street.

1844.

ADVERTISEMENT.

The rapid yet steady growth of the Culture and Manufacture of Silk in the United States is a subject of profound interest and gratification to the Philanthropist and the Patriot, Whenever they shall be so extended and perfected that we as a people become exporters instead of importers of Silk, a vast improvement in the condition of the classes which now subsist on the meagre wages of light and simple labor, such as Sewing, &c., cannot fail to be realized.

But this great National good has thus far been approached often through individual disappointment and loss. Men of rare enterprise, indomitable energy and abundant means, have rushed into the Silk-culture only to encounter misfortune and pecuniary ruin. The great obstacle to their ready success has been the want of adequate knowledge of the new business in which they so eagerly embarked. Individuals have sacrificed thousands and given up the business in despair, when the knowledge of a few simple facts, costing only a few shillings and a few hours' study, had they but known their need and where to look for a remedy, would have secured their perseverance in the work and a competent reward for their toil.

The work herewith submitted to the public, is intended to meet the necessity already indicated. It has been prepared at the instance of several ardent, intelligent pioneers in the Silk Culture, with the aid of Mr. I. R. Barbour, whose familiarity with and success in the business are widely known. It is intended not to embody the experience and the maxims of any one, however eminent for skill, science or good fortune, but to draw from various sources and present within the smallest compass *all* that may be taught through books, of the nature and conditions of the Silk Culture, so as to call into exercise not merely the memory but the understanding and the judgement of the reader. In this view, we have deemed perfect consistency and coherence between the several facts less essential than it may seem to many; since the same treatment throughout may very naturally be less adapted to some than to others of the various climates, soils, &c., of our widespread country. We do not doubt that nearly if not quite every one of the many varieties of the Mulberry may be wisely preferred in some particular location within the United States.

Aside from the assistance of Mr. Barbour, we have freely profited by the article on Silk in Dr. Ure's eminent Dictionary of Arts and Sciences, Mr. Bliss's Report on Silk two years since to the Legislature of Ohio, Mr. Colman's Report to the Massachusetts Legislature, &c.; while we have quoted entire the Silk Manual of the late Mr. Blydenburgh. As it contains very little of our own, we may say without vanity that this book embodies a larger amount of useful information on Silk than any one hitherto published. Is it too much, then, to hope that this work will not merely secure the approbation of those already interested in silk, but that it will induce large additions to their number?

New-York, November, 1843.

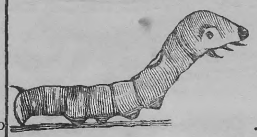
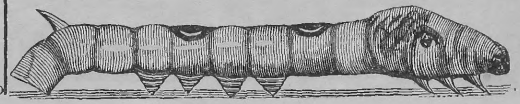
THE SILK CULTURE.

THE SILK WORM.

A SYNOPTICAL TABLE, *Showing the rapid rearing according to the method of* M. CAMILLE BEAUVAIS, *and the process of Ventilation of* M. DARCET.

BY M. BRUNET DE LAGRANGE, PUPIL OF M. BEAUVAIS.

Day of Rearing.	Age of The Worms.	PROGRESS OF THE WORMS.	Temperat're of Cocoon'y. Thermometer Fahrenheit.	Temperat're of Cocoon'y. Hygrometer Saussure.	Number of Feedings.	For one oz. eggs, (about 40,000 worms.) Weight of leaves (not assorted) consumed in 24 hours.	Space occupied by the worms.	No. of persons employed.	Daily Attentions.
						Pounds.	Sq.ft.		
1st,	1st day, 1st age		86	From 70 to 85	24	(a) 1	2	1	The worms are taken from the hatching room to the Cocoonery.
2d,	2d.....do.		84	do.	24	2	2	1	
3d,	3d.....do.		82	do.	24	(b) 4	2	1	Cleaning and separating by means of nets with meshes, ¼ of an inch square. (c)
4th,	4th .....do.		79	do.	24	(d) 1	10	1	
5th,	1st day, 2d age		77	do.	18	(e) 8	10	1	Cleaning.
6th,	2d.....do.		77	do.	18	11	10	1	Cleaning.
7th,	3d.....do.		77	do.	18	1	20	1	Cleaning.
8th,	1st day, 3d age		77	do.	12	7	20	1	Cleaning and separating.
9th,	2d.....do.		77	do.	12	15	20	1	Cleaning and separating.
10th,	3d.....do.		77	do.	12	40	20	1	Cleaning.
11th,	4th .....do.		77	do.	12	30	20	1	Cleaning.
12th,	5th .....do.		77	do.	12	3	50	1	Cleaning.

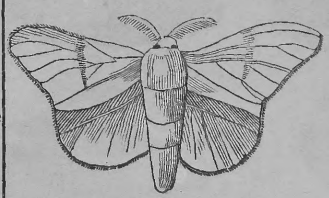
13 th	1st day, 4th age		77	do.	12	(f)	40	50	1	Cleaning.
14 th	2d ..... do		77	do.	12		65	50	1	Cleaning.
15 th	3d ..... do		77	do.	12		100	50	1	Cleaning and separating.
16 th	4th ..... do		77	do.	12		67	50	1	Cleaning and separating.
17 th	5th ..... do		77	do.	12		5	120	1	Cleaning and separating.
18 th	1st d., 5th age		77	do.	8	(g)	70	120	2	Cleaning.
19 th	2d ..... do		77	do.	8		130	120	2	Cleaning.
20 th	3d ..... do		77	do.	8		200	120	2	Cleaning and separating.
21st	4th ..... do		77	do.	8		340	120	2	Cleaning.

22d,	5th	do		77	do.	8	460	120	2	Cleaning.
23d,	6th	do		77	do.	8	300	300	2	Cleaning.
24th	7th	do		77	do.	8	100	300	2	Furnish branches for the worms to spin their Cocoons upon.
							(I) 2000		(H) 31	
30th	.....	6th age		77	do.					Gathering Cocoons.

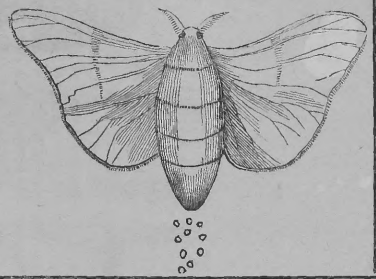
The Worm changes into a Chrysalis immediately after finishing its Cocoon.

40th.....7th age

MALE.



FEMALE.



The room where the moths come out should be dark. They generally begin to appear soon after sunrise. The males at once seek the females; and they should not be allowed to remain united more than eight or nine hours.

The females lay their eggs immediately after separation: each lays from 300 to 500: they are deposited on clean white cloth or paper. Leave the eggs 15 or 20 days in the place where they were laid: then they are kept best in a cellar, at the temperature of 45° or 50° Fahrenheit, until the following year.—Care should be taken to examine them occasionally.

SUMMARY.—Success is probable according as the several changes in the existence of the Worm take place, with the greatest possible uniformity as to time...In order to this, it is necessary to maintain in the Cocoonery: 1st, a high temperature, sufficiently moist and uniformly diffused; 2, a brisk and regular ventilation; 3d, A light, frequent and regular supply of food; 4th, the most particular cleanliness; 5th, an active and unremitted superintendence.

HATCHING...In a heated room or stove.

First Day.....70 to 72° F...

Second Day .....75°.....

Third Day.....77°.....

Fourth Day .....79°.....

Fifth Day .....82°.....

Sixth Day.....84°.....

Seventh Day...HATCHED.86°.....

OBSERVATIONS.

(a) During the first three ages the leaves should be cut very fine; and much time would be saved, and the distribution be more equal, by using, instead of the hand, wire sieves, with meshes about three-quarters of an inch square.

(b) Between the Moultings there is always an increased appetite, called during the first four ages Little Confidence, in the fifth age Great Confidence.

(c) The Cleaning consists in removing the litter from under the Worms, and spreading them so as to leave a space between them equal to their own size. During the last ages the worms on one hurdle are put on two.

(d) At the approach of each change or moulting, the worms raise and toss about their heads, and their appetite diminishes: it is not necessary then to supply leaves except to those which are not quiet; and when all are at rest the supply may cease entirely.

(e) After moulting or the change, increase gradually the quantity of nourishment in proportion to the appetite of the worms.

(f) During the fourth age the leaves are to be cut, but less fine than before.

(g) At the fifth age cease cutting the leaves.

(H) The number of days' work does not augment in proportion to the number of ounces of eggs; because for 10 oz. 200 days are sufficient, and 1100 days for 100 oz.

(I) In 1837, M. Beauvais obtained 185 lbs. of Cocoons from 2000 lbs. of leaves, (1000 kil) not assorted.

The worms are known to be preparing to spin their Cocoons by the following signs: 1st. They discharge all the excrementitious matter contained in them...2d. Their skins, and especially their feet, become transparent, and of the color of the Cocoon they are to spin...3d. They wander about on the leaves without eating, and try to climb upon every thing they meet with, dragging after them slimy threads of Silk.

Each worm requires but three days to wind its Cocoon; but it is not well to remove them until six or eight days, so that the worms which mount latest may have 72 hours, at least, to wind. The best formed Cocoons should be chosen to produce eggs—(one pound of Cocoons will produce an ounce of eggs)—the rest place on hurdles until the suffocation of the Chrysalis, which should take place as soon as possible.

HISTORY

OF

THE SILK CULTURE, &c.

CHAPTER I.

The Silkworm—General Remarks on the Production of Silk—General view of the Nursery.

The silk worm, called by entomologists *Phalæna bombyx mori*, is, like its kindred species, subject to four metamorphoses.* The egg, fostered by the genial warmth of spring, sends forth a caterpillar, which, in its progressive enlargement, casts its skin either three or four times, according to the variety of the insect. Having acquired its full size in the course of twenty-five or thirty days, and ceasing to eat during the remainder of its life, it begins to discharge a viscid secretion, in the form of pulpy twin filaments, from its nose, which harden in the air. These threads are instinctively coiled into an ovid nest round itself, called a cocoon, which serves as a defence against living enemies and changes of temperature. Here it soon changes into the chrysalis or nymph state, in which it lies swaddled, as it were, for about fifteen or twenty days. Then it bursts its cerements, and comes forth furnished with appropriate wings, antennæ, and feet, for living in its new element, the atmosphere. The male and the female moths couple together at this time, and terminate their union by a speedy death, their whole existence being limited to two months. The cocoons are completely formed in the course of three or four days; the finest being reserved as seed worms. From these cocoons, after an interval of eighteen or twenty days, the moth makes its appearance, perforating its tomb by knocking with its head against one end of the cocoon, after softening it with saliva, and thus rendering the filaments more easily torn asunder by its claws. Such moths or aurelias are collected and placed upon a piece of soft cloth, where they couple and lay their eggs.

The eggs, or grains, as they are usually termed, are enveloped in a liquid which causes them to adhere to the piece of cloth or paper on which the female lays them. From this glue they are readily freed, by dipping them in cold water, and wiping them dry. They are best preserved in the *ovum* state at a temperature of about 55° F. If the heat of spring advances rapidly in April, it must not be suffered to act on the eggs, otherwise it might hatch the caterpillars long before the mulberry has sent forth its leaves to nourish them. Another reason for keeping back their incubation is, that they may be hatched together in large broods, and not by small numbers in succession. The eggs are made up into small packets, of an ounce, or somewhat more, which in the south of France are generally attached to the girdles of the women during the day, and placed under their pillows at night. They are, of course, carefully examined from time to time. In large establishments, they are placed in an appropriate stove-room where they are exposed to a temperature gradually increased till it reaches the 86th degree of Fahrenheit's scale, which term it must not exceed. Aided by this heat, nature completes her mysterious work of incubation in eight or ten days. The teeming eggs are now covered with a sheet of paper pierced with numerous holes, about one twelfth of an inch in diameter. Through these apertures the new hatched worms creep upward instinctively, to get at the tender mulberry leaves strewed over the paper.

* Ure's Dictionary of Arts, &c.

Besides the *Bombyx mori*, there are seven species of silkworm, formerly unknown, enumerated by Dr. Helfer as existing in India :* 1. The wild silkworm of the central provinces, a moth not larger than the *Bombyx mori*. 2. The Joree silkworm of Assam, *Bombyx religiosæ*, which spins a cocoon of a fine filament, with much lustre. It lives upon the pipul tree (*Ficus religiosa*), which abounds in India, and ought therefore to be turned to account in breeding this valuable moth. 3. *Saturnia silihetica*, which inhabits the cassia mountains in Silhet and Dacca, where its large cocoons are spun into silk. 4. A still larger *Saturnia*, one of the greatest moths in existence, measuring ten inches from the one end of the wing to the other; observed by Mr. Grant, in *Chira punjee*. 5. *Saturnia paphia*, or the Tusseh silkworm, is the most common of the native species, and furnishes the cloth usually worn by Europeans in India. It has not hitherto been domesticated, but millions of its cocoons are annually collected in the jungles, and brought to the silk factories near Calcutta and Bhagelpur. It feeds most commonly on the hair tree (*Zizyphus jujuba*), but it prefers the *Terminalia alata*, or Assam tree, and the *Bombax heptaphillum* It is called *Koutkuri mooga*, in Assam. 6. Another *Saturnia*, from the neighborhood of Comercolly. 7. *Saturnia assamensis*, with a cocoon of a yellow-brown color, different from all others, called *mooga*, in Assam; which, although it can be reared in houses, thrives best in the open air upon trees, of which seven different kinds afford it food. The *Mazankoory mooga*, which feeds on the Adakoory tree, produces a fine silk, which is nearly white, and fetches fifty per cent. more than the fawn colored. There are generally five breeds of mooga worms in the year; 1. in January and February; 2. in May and June; 3. in June and July; 4. in August and September; 5. in October and November; the first and last being the most valuable.

The management of the worms, and more particular directions for the Nursery will be given in a subsequent part of the work, but in order to render what follows intelligible to the general reader, we here give a very general view of the operations of the Nursery, as conducted in France at the present time.

The nursery where the worms are reared is called by the French a *magnanière*;† it ought to be a well-aired chamber, free from damp, excess of cold or heat, rats, and other vermin. It should be ventilated occasionally, to purify the atmosphere from the noisome emanations produced by the excrements of the caterpillars and the decayed leaves. The scaffolding of the wicker-work shelves should be substantial; and they should be from fifteen to eighteen inches apart. A separate small apartment should be allotted to the sickly worms. Immediately before each moulting, the appetite of the worms begins to flag; it ceases altogether at that period of cutaneous metamorphosis, but revives speedily after the skin is fairly cast, because the internal parts of the animal are thereby allowed freely to develope themselves. At the end of the second age, the worms are half an inch long; and then should be transferred from the small room in which they were first hatched, into the proper apartment where they are to be brought to maturity and set to spin their balls. On occasion of changing their abode, they must be well cleansed from the littter, laid upon beds of fresh leaves, and supplied with an abundanee of food every six hours in succcssion. In shifting their bed, a piece of network being laid over the wicker plates, and covered with leaves, the worms will crcep up over them; when they may be transferred in a body upon the net. The litter, as well as the sickly worms, may thus be readily removed, without handling a single healthy one. After the third age, they may be fed with entire leaves; because they are now exceedingly voracious, and must not be subsequently stinted in their diet. The exposure of chloride of lime, spread thin upon plates, to the air of the *magnanière*, has been found useful in counteracting the tendency which sometimes appears of an epidemic discase among the silkworms, from the fetid exhalations of the dead and dying.

When they have ceased to eat, either in the fourth or fifth age, agreeably to the varicty of the *bombyx*, and when they display the spinning instinct by crawling up among the twigs of heath, &c., they are not long of beginning to construct their cocoons, by throwing the thread in different directions, so as to form the floss, filoselle, or outer open network, which constitutes the *bourre* or silk for carding and spinning.

The cocoons destined for filature, must not be allowed to remain for many days with the worms alive within them; for should the chrysalis have leisure to grow mature or come out, the filaments at one end would be cut through, and thus lose almost all their value. It is therefore necessary to extinguish the life of the animal by heat, which is done either by exposing the cocoons for a few days to sunshine, by placing them in a hot oven, or in the steam of boiling water. A heat of 202° F. is sufficient for effecting this purpose, and it may be best administered by plunging tin cases filled with the cocoons into water heated to that pitch.

Eighty pounds French (eighty-eight English) of cocoons, are the average produce from one ounce of eggs, or one hundred from one ounce and a quarter. The silk obtained from a cocoon is from seven hundred fifty to one thousand one hundred fifty feet long. The varnish by which the coils are glued slightly together, is soluble in warm water.

The silk husbandry, as it may be called, is completed in France within six weeks from the end of April, and thus affords the most rapid of agricultural returns, requiring merely the advance of a little capital for the purchase of the leaf.

The most hazardous period in the process of breeding the worms, is at the third and fourth moulting; for upon the sixth day of the third age, and the seventh day of the fourth, they in general eat nothing at all. On the first day of the fourth age, the worms proceeding from one ounce of eggs will, according to Bonafons, consume upon an average twenty-three pounds and a quarter of mulberry leaves; on the first of the fifth age, they will consume forty-two pounds; and on the sixth day of the same age, they ac-

* Ure's Dictionary. † Ibid.

quire their maximum voracity, devouring no less than two hundred twenty-three pounds. From this date their appetite continually decreases, till on the tenth day of this age they consume only fifty-six pounds. The space which they occupy upon the wicker tables, being at their birth only nine feet square, becomes eventually two hundred thirty-nine feet. In general, the more food they consume, the more silk will they produce.

CHAPTER II.

Early History of Silk—Introduction into Europe—Into the United States.

The earliest mention that is made of silk,* is in the translation of the Bible, by Jerome, who speaks of it as one among the articles which the Phœnicians imported from Syria. The exceeding beauty of the fabric rendered it particularly attractive to mankind, wherever it was known. It was brought, for a long time, by traders from China, in caravans, through the sands and deserts of Asia to the ports of Syria and Egypt. The distance which it was brought, and the consequent difficulty of procuring it in large quantities, made it very expensive. Dionysius Periegetes, the geographer, who was sent by Augustus to compile an account of the Oriental regions, gave to his countrymen the astonishing information that precious garments were made by the Seres, the inhabitants of what is now Bucharia, from threads finer than those of the spider. And among all the gorgeous displays made by the renowned and luxurious Cleopatra, none excited so strongly the admiration, the unmixed astonishment of the people, as the silk sails of her pleasure bark.

For centuries, the silk trade was monopolized by the Persians. When they were subdued by Alexander, the commodity was brought to Greece, and thence to Rome. The anxiety of the Romans to trade directly with the producers of this costly material, induced the emperor, Marcus Antoninus, to send embassadors to their country to negotiate a direct commercial intercourse with them.

Soon after Justinian ascended the throne, he sent Julian as his ambassador to the Christian King of Axuma, in Abyssinia, appealing to him that, for the sake of their common religion, he would assist him in war with Persia, and direct his subjects to buy silks in India and sell them to the Romans, by which means the Axumites would acquire great wealth, and the Romans would have the satisfaction of paying their money to their friends, instead of to their Persian enemies.

But the culture of silk was finally introduced into Europe, in a singular manner. The preachers of the Nestorian religion, having been persecuted by the Ecclesiastical Government at home, fled from Byzantium into India. Their Patriarch, who resided in Persia, sent missionaries abroad, and established convents in various parts of India. Two of his monks, who had been employed as missionaries, penetrated into the country where silk was produced and manufactured, and became acquainted with its culture, and the art of manufacturing it into elegant fabrics. Knowing the anxiety of the Europeans to possess this knowledge, they imparted the secret to the Emperor Justinian, that silk was produced by a species of worm, whose eggs could easily be transported. By the promise of a great reward, they were induced to return, and they carried safely to Constantinople a quantity of silk worms' eggs, in the *hollow of a cane;* and the worms from these few eggs, thus brought from India, may properly be considered the progenitors of all that have since been reared in Europe or Western Asia. From this the culture gradually spread over different parts of Europe; but the use of it was still confined to the courts of Emperors and Kings, and to the wealthier classes of the people. And it was not until in the sixteenth century that the culture and manufacture became so extensive as to warrant any thing like a common use of it; and even then, it was, comparatively, used but by few.

About 1130, Roger II., king of Sicily, set up a silk manufacture at Palermo,* and another in Calabria, conducted by artisans whom he had seized and carried off as prisoners of war in his expedition to the Holy Land. From these countries, the silk industry soon spread throughout Italy. It seems to have been introduced into Spain at a very early period, by the Moors, particularly in Murcia, Cordova, and Granada. The last town, indeed, possessed a flourishing silk trade when it was taken by Ferdinand in the 15th century. The French having been supplied with workmen from Milan, commenced in 1521 the silk manufacture; but it was not till 1564 that they began successfully to produce the silk itself, when Traucat, a working gardner at Nismes, formed the first nursery of white mulberry trees, and with such success, that in a few years he was enabled to propagate them over many of the southern provinces of France. Prior to this time, some French noblemen, on their return from the conquest of Naples, had introduced a few silkworms with the mulberry into Dauphiny; but the business had not prospered in their hands. The mulberry plantations were greatly encouraged by Henry IV.; and since then they have been the source of most beneficial employment to the French people.

James I. was most solicitous to introduce the breeding of silkworms into England, and in a speech from the throne he earnestly recommended his subjects to plant mulberry trees; but he totally failed in the project. This country does not seem to be well adapted for this species of husbandry, on account of the great prevalence of blighting east winds during the months of April and May, when the worms require a plentiful supply of mulberry leaves. The manufacture of silk goods, however, made great progress during that king's peaceful and pompous reign. In 1629 it had become so considerable in London, that the silk-throwsters of the city and suburbs were formed into a public corporation. So early as 1661, they employed 40,000 persons. The revocation of the edict of Nantes, in 1685, contributed in a remarkable manner to the increase of the English silk trade, by the influx of a large colony of skilful French weavers, who settled in Spitalfields. The great silk-throwing mill mounted at Derby, in 1719, also served to promote the exten-

* Report of Mr. Bliss to the Legislature of Ohio.

* Ure's Dictionary of Arts, &c.,

sion of this branch of manufacture; for soon afterward, in the year 1730, the English silk goods bore a higher price in Italy than those made by the Italians, according to the testimony of Keysler.

PRODUCTION OF SILK IN THE UNITED STATES.

The production of silk in the United States* has been repeatedly brought before the public; and presented in various forms as a subject of general interest to the agricultural community. When the State of Georgia was settled, silk and wine were recommended as particular objects of culture. In Virginia measures were taken as early as 1663 to encourage the gencral production of silk; and the failure to plant mulberry trees at the rate of ten for every hundred acres, was made by the laws a penal offence. In 1760, the society in London for the encouragement of arts, manufactures, and commerce, offered liberal premiums for the production of silk in Georgia, Pennsylvania, and Connecticut. "The socicty propose to give for every pound weight of cocoons produced in the Province of Connecticut in the year 1759, of an hard, weighty, and good substance, wherein one worm only has spun three pence; for every pound weight of cocoons of a weaker, lighter, spotted, or bruiscd quality, though only one worm has spun in them two pence; for every pound of cocoons, produced in the same year, wherein two worms are interwoven, one penny. These premiums will be paid on condition that a public filature be established in Connecticut, and that each person bring his or her balls to such public filature." This invitation, says Jared Eliot, in his remarkable essays on Field Husbandry in New England, is not to a business to which we are wholly strangers; it is not to an empty, airy, and untried project; for there has been something of this manufactory carried on for sundry years, and by a number of our people in divers of our towns by which we are assured that it is practicable. As early as 1747, the governor of Connecticut, Mr. Law, wore the first coat and stockings made of New-England silk; and in 1750, his daughter wore the first silk gown of domestic production.

In an almanac of Nathaniel Ames, for the year 1769, it seems the subject had been matter of much public discussion, and "a gentleman, whom posterity will bless, deposited one hundred dollars in the hands of the sclectmen of Boston; forty dollars to be given to the person, who in the year 1771, shall have raised the greatest quantity of mulberry trees; thirty dollars to him that shall have the next greatest number; twenty to the next; and ten to the next; certificate being produced from a justice of the peace of the number, and that they belong to Massachusetts Bay." It is added that, "Justinian, the emperor, looking upon it as a great hardship that his subjects should buy the manufacture of the Persians at so dear a rate as a pound of gold for a pound of silk, dispatched two monks into India to discover and learn how the silk trade was managed there; and to bring a quantity of those insects from whom he was informed the silk was produced, when they brought at a second voyage, great quantity of silk worms' eggs." This writer adds, "It is but of late years that the Europeans fell into the way of cultivating any quantity of raw silk. The Italians led the way; and they have been followed with great success by the French; and the advantages thereof to these nations are amazing, as they supply Great Britain with raw silk for the thousands of spinners and weavers constantly employed in Spitalfields. It being certain that raw silk is plentifully raised in much more northern climates than this, we have a most promising prospect of one day turning the constant course of prodigious sums of money from Spain, France, and Italy into America."

It is further stated by Eliot, in 1762, "that by a late account from Georgia, it appears that the silk manufactory is in a flourishing way. In the year 1757, the weight of silk balls received at the filature, was only 1,050; last year produced 7,040, and this year about 10,000; and it is very remarkable that the raw silk exported from Georgia, sells at London from two to three shillings a pound more than that from any other part of the world." It is stated by President Stiles, that in 1762 Georgia exported to London 15,000 lbs. cocoons, deemed sufficient to make 1500 lbs. of silk.

Other remarks of Eliot, considering the time when he wrote, are particularly deserving of attention. He commends especially the cultivation of silk to the northern colonies, "who are destitute of any staple commodity by which they could make an immediate and direct return to England, for such goods as we want, and must always want, more abundantly than we have means at present by which we can refund. This seems to be the state of Georgia, Pennsylvania, and Connecticut." The cultivation of the great staple of cotton was not pursued then to any extent in the Southern States.

He goes on to say that, "those among us, who raise silk, say, that it is more profitable than other ordinary business. Some years past, I asked a man of good faith and credit, who had then made the most silk of any among us, what profit might be made of it. His reply was that he could make a yard of silk as cheap as he could make a yard of linen cloth of eight run to the pound. A woman of experience in this business told me, that, in the short time of feeding the worm and winding the silk balls, she could earn enough to hire a good spinner the whole year. I have not the least scruple of the informer's veracity, but how far their capacity might serve for an exact calculation, I know not."

"We labor under such difficulties to make returns for goods imported, that many have thought it would be best that we should make our own cloths and by this means lessen our importation, which indeed would be better than to run into an endless and irrecoverable debt; but there is now a way opened by which, if we are not wanting to ourselves, we may not only continue but increase our importation, for if the same cost, labor, and time which we expend in making one yard of cloth, if laid out in raising silk will procure two yards of the same sort of cloth, and manufactured by more skilful hands, it is easy to see which is the most eligible method."

In 1772, as appears from the manuscript journal of President Stiles of Yale College, his family

* Colman's Report on the Agriculture of Massachusetts.

engaged, to some extent, in the culture of silk, and their production was sent to England to be manufactured, a sample of which cloth, presenting a singularly beautiful fabric, together with the journal itself, is now in my possession.*

About the year 1770, a filature was established in Philadelphia, and it is a remarkable fact that from the 25th of June to the 15th of August 1771, two thousand three hundred pounds of cocoons were brought to the filature to be reeled, or were bought by the managers. These came from Pennsylvania, New-Jersey, and Delaware.†

About the year 1760, the culture of silk was introduced into Mansfield, Conn., and some of the neighboring towns. It has been pursued ever since that time, to a small extent, in several other places in New-England; but it cannot be said to have maintained its foothold in any other situation than in Mansfield. In other places, where it planted itself with every favorable prospect of success, it presently expired. In Mansfield, Conn., it has continued to be pursued to the present time. The largest amount of raw reeled silk reported to have been produced in any one year in Mansfield, as was stated to me in that town, has been about seven thousand pounds. In general, however, it has not exceeded three thousand pounds per year. The inhabitants of Mansfield have been wholly dependent upon the white mulberry for feed for their worms; and a large proportion of these were destroyed in the severe winter of 1834–5.

In all these experiments, made in the Northern, Southern and Middle States, it was found, that our climate and soils every where produced silk of a superior quality, and that commanded a high price. The same is true at the present day, for the same sun shines, and the same winds blow.

But in those early times, there were causes that forbid a wide extension, or the permanent establishment of the business. The population of the country was sparce. In some parts indigo, rice and tobacco were supposed to be more profitable. The revolutionary war broke up the filatures North and South, and then came on the cotton culture, which, at the South, has swallowed up every thing else to the present day.

All this while, be it remembered, it was the white mulberry on which they fed, which involved expenditures in labor at least two or three times as large as feeding from the best foreign varieties of the mulberry lately introduced.

But the main difficulty was the want of a regular home market for cocoons and raw silk. Cocoons will not bear shipment, nor will they bear distant land transportation. They require a home market. We had no silk manufacturing establishments to present such markets. Up to 1816, the entire feeling of the country, a feeling industriously instilled from the very infancy of our settlements, by the mother kingdom, was in opposition to domestic manufactures of every description. The clock reel, the spinning wheel, and hand loom, constituted all the machinery that was thought befitting our circumstances, as an agricultural and a commercial people.

In this state of things, *silk* factories of course would not start up. Hence the silk grown, was generally worked up in families into sewings and hosiery, and bartered at the village stores for goods. Nobody thought of getting cash for it.

The silk culture became strongly the subject of public attention in 1826.* Congress encouraged it, by the publication and distribution of large editions of manuals and treatises, prepared with great care and fullness, and giving all the directions and details necessary to the prosecution of the business, from the raising of the trees, to the preparation of the article for use. The vast amounts of money annually sent abroad for the purchase of this article of universal use and almost of necessity, the increasing use of the article among all classes of people, and to an extent probably not known in any other country; and, at the same time, the acknowledged capacity of the country to produce silk, and of the best quality, gave new prominence to the subject in the community, and drew the public attention to it with an intense interest; but with no greater interest than in an economical view, in the opinion of many intelligent men, its national importance may justly claim.

The first attempt to manufacture sewing silk by machinery, was made in Mansfield, Conn., in 1829, by Capt. Joseph Conant, and Mr. Atwood. They succeeded in making a good article, though for a time, amidst many losses and discouragements. But Yankee skill and pereverance triumphed. They pushed the business through, and are still engaged in it vigorously and successfully—the former in the firm of Conant & Swift, Northampton, Mass., and the latter in the firm of Atwood & Crane, Mansfield, Conn.

Since 1829, a few other factories have been established for the manufacture of sewings, twist, galoons, fringes, coach lace, handkerchiefs, velvets and piece goods, and are now in successful operation. They are found in Massachusetts, Connecticut, New-Hampshire, New-York, New-Jersey, Pennsylvania, Ohio, Tennessee, and elsewhere. Others are in contemplation, and will spring up in different localities as fast as circumstances will permit. In this way local cash markets are created for cocoons and raw silk, to any extent that may be desired, thus alleviating the great difficulty formerly experienced; and securing, it is fully hoped, the regular extension of the silk culture throughout all the States, and the complete establishment of the silk business, growing and manufacturing, as a part of the permanent industry of the country.

In 1831, the introduction of a new plant into the country, (the *Perottet Mulberry*, or *Morus Multicaulis*,) which promised from its extraordinary capacity of rapid multiplication, and its productiveness of foliage, to furnish superior advantages for the prosecution of the silk culture, gave a new impulse to the cause, and roused public enthusiasm to a high degree of fervor.

In the year 1836, the subject of Silk Culture in the United States was brought before the public by a communication from General *Tallmadge*, then on a tour through Europe, which appeared in the Journal of the American Institute. We here insert such parts of the communication referred to as relate to the Silk business, inasmuch

* I. R. Barbour of Oxford, Mass.

†, Hazard's Register of Pennsylvania, p. 64.

* Colman's Agricultural Report.

as the publication at the time spoken of excited considerable interest in the subject, and now forms an interesting portion of the history of Silk Culture in the United States :—

"Since I arrived in this land of fame and fable, I have not been unmindful of the culture of silk, so justly a subject of great and growing interest to our country. I have visited several manufactories of silk. It is not the season for seeing the silk worm, but most of its progress in other respects I have been able to see. I have made many inquiries in hopes of obtaining useful information. Finizio is an extensive manufacturer of sewing silk; he makes about three thousand pounds a week, which is mostly sent to the New York market. He is an intelligent man, and I found him willing to answer my inquiries; as also were several other establishments, and which mostly confirmed his statement. The sewing silks of Naples are mostly made from the silk grown in *Calabria*, where the worm is fed principally upon the *black* mulberry, and which makes the strongest and best for sewing silk.—Finizio stated that the worm fed on the black mulberry made the strongest thread; *that* on the *white* mulberry, finer and better for fabrics; *that* on the Chinese mulberry still finer and more delicate. When asked if the cocoon from the Chinese mulberry required more skilful and delicate work to wind and work it, he said it did, and immediately produced two skeins, one of which he said was from the black mulberry, (from a bush, perhaps, eight or ten feet in circumference,) the other from a bush about four feet. The lesser bush, he said, was less liable to break the thread in winding from the cocoon, and was used in finer silks for fabrics. The black mulberry produced a stronger thread, and would bear the larger reel, and was principally used in that business. The silk here is mostly made in the country by families in detail, and much of it reeled there, and in this condition it is brought to market. For sewing silk it is doubled as often as required, and twisted as much. This process is wholly in a *dark room*. The silk is worked wet, and for this purpose, to preserve a uniformity, the atmosphere is kept damp, the daylight excluded, and the work carried on with small hand lamps. The machine was turned by men harnessed like mules. I have since been out about twenty miles to the silk factory of the king, which is worked by water power, and by which the cocoons are also reeled. I stated to Finizio, as well as at the king's factory, that the Italian sewing silk was sold in the American markets by its weight, while the American sewing silk was sold by the skein; and that one pound of the Italian would have perhaps two hundred and fifty skeins, while one of the American silk would have about three hundred and fifty skeins. The cause of this difference of weight, or why the American sewing silk has a tendency to curl or knot, they could not explain without a sample, but said the weight of sewing silk could be diminished or very considerably augmented in the *dyeing*, and that good dyeing required the silk to be well *boiled* in *soap*, after which it was put into an acid, and was there prepared for the process of the dye, according to the color, as desired. The gloss, or dressing, seems to be produced by beating and twisting on a post, which, with the manual labor put upon its finish, it is supposed, prevents its tendency to knot.

"I asked if the color of the cocoon, yellow or white, gave any difference of value, or indicated a sickly worm, and the answer was that the color was casual, and the value the same; that a selection of white or yellow cocoons from which to get eggs would probably produce a like color; and Mr. Finizio said he had some customers who had so selected and brought him *cocoons* entirely *white;* and that for white ribbons or fabrics, they commanded a greater price of from three to five per cent., though otherwise of equal value.

"I have made many other inquiries and observations on this subject, but which in the limits of a letter cannot be detailed. The eggs are here in market during most of the year, and by being kept in a *grotto*, or cold damp place, the worm can be produced as required. The sirocco, or hot south wind, is here the greatest enemy of the silk worm, and sometimes suddenly destroys so many of the worms as to require the reproduction of another class, from eggs in reserve. They should be sheltered from this wind, and ventilation should be given them from above or by back windows. I think we have sometimes a like south, or south-west, wind, which should be guarded against, and which our gardeners call a *red wind*, from a rust produced by it on peach and apricot trees, which curls up and burns the young leaves, and often kills the trees, and is said to affect the mulberry trees in like manner.

"The black mulberry tree is a native of our country, and is common in Dutchess county, especially in Fishkill. It is, on my farm, a common tree. It is as valuable for posts and timber as red cedar. If the suggestions of Mr. Finizio, and others, as to the black mulberry, are correct, as being better for *sewing silk*, and more easily reeled, is not the matter worthy of attention? and especially in the first effort, and until skill and experience is obtained? The *black* mulberry can be immediately used, while a few years will be required to rear the Chinese, and obtain the silk for its more delicate work. My most excellent and lamented wife, in the few last years of her declining health, occupied her active mind in some experiments with the silk worm. She placed some of the eggs in the fall of the year, and left them, during the severe cold of the winter, in an upper chamber; and others she placed in a family room not affected by the frosts; in the spring season they produced the silk worm equally well; she put some eggs in the *ice house*, not on the *ice*, but on the *straw*, and in its atmosphere; and some time, I think, in July, they were brought out, and produced their worms in good condition. She fed one hundred worms on the black mulberry, one hundred on the white, one hundred on the Chinese, and one hundred on the black in their early stages, and, in the last stage, before making their cocoons, upon the Chinese;—all succeeded well. Those fed on the black, seemed to produce the strongest thread and most easily wound; the white the next, but with little difference; those fed wholly on the Chinese no ways different from those fed in the last stage, but greater difficulty to wind the Chinese than either those of the black or white. She had the publications made in our

State, as well as those by order of Congress on the culture of silk, as her instructions. The impulse of her mind was to assist in procuring a profitable family employment for children, for females and infirm persons; without which she considered that the noble system of our Sunday free schools and charitable institutions, was not carried to the full extent of their benevolence.—The hope of this consummation affords a cheering prospect. A wide field is presented, in which the philanthropist, the moralist, and the political economist may jointly labor, and, in their efforts, greatly promote the public good. Whoever has seen the condition of the common people of Europe, and especially the idle beggars of Ireland and of Italy, will appreciate the indispensable necessity of attention to this growing evil with us. It is a maxim of political economy that 'demand begets supply,' and experience has shown that every charity is over-crowded. The towns of England are holding meetings, and resolving not to contribute to street beggary, but to give tickets on certain officers, who are to examine and afford ample relief to the afflicted, and send them to the houses of correction and confinement. The culture of silk will afford an additional and valuable employment, and should be connected with our charities; and employment of some kind should be provided in the houses of correction, which will be the most effectual charity.

"But even as a new staple for the country, and a new article of production in common families, the culture of silk will be an invaluable acquisition. I have made every observation in my power, and I am fully convinced that the culture of silk will be found suitable to our climate, and well adapted to our country and people. Calabria, though south of Naples, is mountainous, and a much colder climate than ours. The Milan and Piedmontese silk is the best, and is much sought after in the London market. Those districts are in the North of Italy, and near the Alps. I think the production of the worm should be delayed until after the usual cold storm to be expected from the 15th to the 25th May. Our month of June would be the most desirable as a first establishment for them. If families can be induced to the growing of the cocoon, the women and children will soon produce as much from the mulberry trees about the house and along the fences, as the father can make on the clear profit of his farm. Thermometers or fires are not much used in Italy, the season giving the temperature required. The business must be simplified, and freed from too much instruction, to secure its success with us. The difficulty to extract reasons or information from the common people of the continent is so evident, and they so essentially differ from our American people in their aptitude to give reasons and explanations, that I say—do not seek to receive too much European instruction, but rely on the producible common sense of our people; this fund will not fail or be insufficient, and, with a little experience, I am sure of success in the culture of silk in our country. Induce the growing of the cocoons, and the object will be accomplished. It is a very simple business. I shall continue my observations on this important and interesting subject, in my tour through France; but if our American merchants and dealers in silks from Italy and France, could be induced to introduce the culture of silk, and obtain from time to time information from their correspondents, they would be a host of strength in the business. I have found the *operatives* here rather a prejudiced and uncertain source for information. They work, but cannot tell the why or wherefore."

"Since my last, I have travelled through Italy, and especially in the silk districts, and also through France, and have visited many of the manufactories in both countries, endeavoring to learn the details of this subject, now so interesting, and, I think, so essential to our country.—The limits of a letter will, however, confine me to a few isolated remarks.

"The weaving of silk, after it gets into skeins, is like any other weaving of like character; it is the production of silk, and the habit of growing it, that must be acquired by our country; and it is, in this view, a mine of boundless wealth, not second even to the production of cotton. The country which so lately surprized Europe by sending *eight* bales of cotton to its market, and now astonishes the world with its countless thousands, may soon exhibit a like wonder in the production of its silk.

"In Calabria, which is in the south of Italy, the black mulberry is principally used. In the rest of Italy the white mulberry, common to them and to France, is principally used. The north of Italy—that is, between the Alps and the Appenines—produces the most and the best silk. In this region, and especially in Sardinia, near Turin, and at *Novi*, the English and French are competitors in market, to purchase their silk as the best in the world; and yet on the 9th of March, the snow was one foot and a half deep, and the streets of Novi blocked up like our Cedar street! In Calabria the silk is produced by the country people, in their families, and mostly reeled by them. There are very few factories for reeling in the Neapolitan kingdom. In Lombardy, and towards *Venice*, there are also establishments for reeling, yet the greater part is reeled by the families, in detail, and brought to the market in the skein. In Sardinia the cocoons are mostly reeled in establishments. At *Novi* their reeling establishments are numerous. I saw one, now erecting, which is a quadrangle *two hundred* feet square, and appropriated solely to reeling cocoons. They are purchased up from near Milan, and many miles distant. This is admitted to be the best silk in the world. The *red* mulberry is here principally used, and is known as the Calabria mulberry. It is described as having a dark fruit; the tree is like our *black;* and when I called it *black* mulberry, I was corrected, and told the *stain of the fruit* was *red*, and not *black*, and which gave the character of the tree. The French, in addition to the *white* mulberry, have a *dwarf* white, much liked, and getting into use; but, it must be remembered, there is not in France, and scarcely in Italy, a fence, and they do not graze their fields as we do. With our habit of pasturage, the dwarf would be inadmissible. The *Chinese* mulberry is unknown in Italy. I found only a few young engrafted trees, but no experiments there, to be relied upon, to establish its superior utility. In Italy, and in France, the

mulberry is generally planted near the houses, along the road sides, by division fences, and often like an open orchard. The trees are formed like a middle-sized apple tree. Its shade does not injure the land. The tree in Italy is usually made to sustain a grape vine, and the field is cultivated for wheat and other crops. There is less discrimination here than you would imagine in the kind of Mulberry. The French have made experiments, especially on the *Chinese;* and the opinion seems to be, that the *Chinese* mulberry will bear to have its leaves twice picked off, and thus produce two crops of silk in one year. As yet, however, there is not much use made of the Chincse mulberry, even here, and the grower of silk cannot answer as to its virtues;—but the answer is often given to me, that, as to the *quality* and the *quantity* of the silk, it is the *same* as any other mulberry; and that the quality of the silk depends on the treatment of the worm, and the care and skill in reeling. Thcy pay less attention to the *kind* of mulberry on which it is fed than we expect. They have also *white*, and use it. *Habit* directs more in Europe than with us; and therefore I urge that our people make experiments for themselves. They should neither take nor reject any thing too quickly upon European experience. Climate and circumstances may produce a different result, and the alleged experiments of Europe may have been incorrectly or inadequately tried.

"It is a peculiar and important circumstance in favor of the adaptation and fitness of our climate to the culture of silk, that, with us, the silk worm is produced at the beginning of warm weather, in May and June, by the natural temperature of the season, while in Europc, and especially in Italy and France, it is produced only by artificial temperature and means. This fact is a volume in promise for our country. Fires and a thermometer are not used in the south of Italy to secure an equal temperature in the rooms of the worms, nor much used in the north of Italy, unless in the region of some snow-capped mountain, or where other circumstances produce sudden inequalities of temperature. It is the same as to the south and north of France.

"The books already published, by Congress and our State, give the best, and indeed all the instructions which can be given on the subject; and with these, as guides, let the safe and unerring common sense of our people make experiments for themselves; and, I venture to say, the time is not far distant when America will produce silk in abundance from practical information and science, while other countries will continue to do it from habit."

CHAPTER III.

Silk Manufacture—Specific Gravity—Raw Silk—Assamese Cocoonery—Silk Filature—Reeling—Throwing Mills.

Before proceeding farther in the history of the Silk Manufacture in the United States, or entering upon the practical details of the business, we will present such a sketch of the process of manufacturing, through all the various stages. as we trust will render the subject intelligible and interesting to the general reader. We avail ourselves of the article in *Ure's Dictionary of Arts and Manufactures* as affording the fullest and most satisfactory descriptions of the material, process and machinery; although in several particulars it will be found to differ somewhat from the mode adopted in this country.

Silk Manufacture may be divided into two branches: 1. thc production of raw silk; 2. its filature and preparation in the mill, for the purposes of the weavcr and other textile artisans. The threads, as spun by the silkworm, and wound up in its cocoon, are all twins, in consequence of the twin orifice in the nose of the insect through which they are projected. These two threads are laid parallel to each other, and are glued more or less evenly together by a kind of glossy varnish, which also envelopes them, constituting nearly twenty-five per cent. of their weight. Each ultimate filament measures about 1-2000th of an inch in average fine silk, and the pair measures of course fully 1-1000th of an inch. In the raw silk, as imported from Italy, France, China, &c., several of these twin filaments are slightly twisted and agglutinated to form one thread, called a single.

The specific gravity of silk is 1.300, water being 1.000. It is by far the most tenacious or the strongest of all textile fibres, a thread of it of a certain diameter being nearly three times stronger than a thread of flax, and twice stronger than hemp. Some varieties of silk are perfectly white, but a general color in the native state is a golden yellow.

There are three denominations of raw silk; viz., organzine, *trame* (shute or tram), and floss. Organzine serves for the warp of the best silk stuffs, and is considerably twisted; tram is made usually from inferior silk, and is very slightly twisted, in order that it may spread more, and cover better in the weft; floss, or *bourre*, consists of the shorter broken silk, which is carded and spun like cotton. Organzine and trame may contain from three to thirty twin filaments of the worm; the former possesses a double twist, the component filaments being first twisted in one direction, and the compound thread in the opposite; the latter receives merely a slender single twist. Each twin filament gradually diminishes in thickness and strength, from the surface of the cocoon, where the animal begins its work in a state of vigor, to the centre, where it finishes it, in a state of debility and exhaustion; because it can receive no food from the moment of its beginning to spin by spouting forth its silky substance. The winder is attentive to this progressive attenuation, and introduces the commencement of some cocoons to compensate for the termination of others. The quality of raw silk depends, therefore, very much upon the skill and care bestowed upon its filature. The softest and purest water should be used in the cocoon kettle.

The quality of the raw silk is determined by first winding off four hundred ells of it, equal to four hundred seventy-five metres, round a drum one ell in circumference, and then weighing that length. The weight is expressed in grains, twenty-four of which constitute one denier; twenty-four deniers constitute one ounce; and sixteen ounces make one pound, *poids de marc.*

This is the Lyons rule for valuing silk. The weight of a thread of raw silk four hundred ells long, is two grains and a half, when five twin filaments have been reeled and associated together.

Raw silk is so absorbent of moisture, that it may be increased ten per cent. in weight by this means. This property has led to falsifications; which are detected by enclosing weighed portions of the suspected silk in a wire-cloth cage, and exposing it to a stove heat of about 78° F. for twenty-four hours, with a current of air. The loss of weight which it thereby undergoes, demonstrates the amount of the fraud. There is an office in Lyons called the *Condition*, where this assay is made, and by the report of which the silk is bought and sold. The law in France requires, that all the silk tried by the *Condition* must be worked up into fabrics in that country.

The Assamese select for breeding, such cocoons only as have been begun to be formed in the largest number on the same day, usually the second or third after the commencement; those which contain males being distinguishable by a more pointed end. They are put in a closed basket suspended from the roof; the moths, as they come forth, having room to move about, after a day, the females (known only by their large body) are taken out, and tied to small wisps of thatching-straw, selected always from over the hearth, its darkened color being thought more acceptable to the insect. If out of a batch, there should be but few males, the wisps with the females tied to them are exposed outside at night; and the males thrown away in the neighborhood find their way to them. These wisps are hung upon a string tied across the roof, to keep them from vermin. The eggs laid after the first three days are said to produce weak worms. The wisps are taken out morning and evening, and exposed to the sunshine, and in ten days after being laid, a few of them are hatched. The wisps being then hung up to the tree, the young worms find their way to the leaves. The ants, whose bite is fatal to the worm in its early stages, are destroyed by rubbing the trunk of the tree with molasses, and tying dead fish and toads to it, to attract these rapacious insects in large numbers, when they are destroyed with fire; a process which needs to be repeated several times. The ground under the trees is also well cleared, to render it easy to pick up and replace the worms which fall down. They are prevented from coming to the ground by tying fresh plantain leaves round the trunk, over whose slippery surface they cannot crawl; and they are transferred from exhausted trees to fresh ones, on bamboo platters tied to long poles. The worms require to be constantly watched and protected from the depredations of both day and night birds, as well as rats and other vermin. During their moultings, they remain on the branches; but when about beginning to spin, they come down the trunk, and being stopped by the plantain leaves, are there collected in baskets, which are afterwards put under bunches of dry leaves, suspended from the roof, into which the worms crawl, and form their cocoons—several being clustered together: this accident, due to the practice of crowding the worms together, which is most injudicious, rendering it impossible to wind off their silk in continuous threads, as in the filatures of Italy, France, and even Bengal. The silk is, therefore, spun like flax, instead of being unwound in single filaments. After four days the proper cocoons are selected for the next breed, and the rest are uncoiled. The total duration of a breed varies from sixty to seventy days; divided into the following periods:

Four moultings, with one day's illness attending each	20
From fourth moulting to beginning of cocoon - -	10
In the cocoon 20, as a moth 6, hatching of eggs 10	36
	66

On being tapped with the finger, the body renders a hollow sound; the quality of which shows whether they have come down for want of leaves on the tree, or from their having ceased feeding.

As the chrysalis is not soon killed by exposure to the sun, the cocoons are put on stages, covered up with leaves, and exposed to the hot air from grass burned under them; they are next boiled for about an hour in a solution of the potash, made from the incinerated rice stalks; then taken out, and laid on cloth folded over them to keep them warm. The floss being removed by hand, they are then thrown into a basin of hot water to be unwound; which is done in a very rude and wasteful way.

The plantations for the mooga silkworm in Lower Assam, amount to 5,000 acres, besides what the forests contain; and yield one thousand five hundred maunds of eighty-four pounds each per annum. Upper Assam is more productive.

The cocoon of the *Koutkuri mooga* is of a size of a fowl's egg. It is a wild species, and affords filaments much valued for fishing lines.

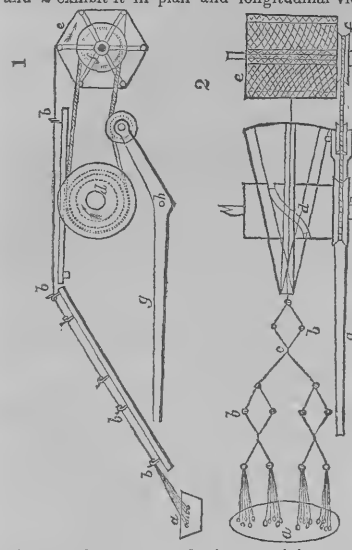
8. The *Arrindy* or *Eria* worm, and moth, is reared over a great part of Hindostan, but entirely within doors. It is fed principally on the *Hera or Palma christi* leaves, and gives sometimes twelve broods of spun silk in the course of a year. It affords a fibre which looks rough at first; but when woven, becomes soft and silky, after repeated washings. The poorest people are clothed with stuff made of it, which is so durable as to descend from mother to daughter. The cocoons are put in a closed basket, and hung up in the house, out of reach of rats and insects. When the moths come forth, they are allowed to move about in the basket for twenty-four hours; after which the females are tied to long reeds or canes, twenty or twenty-five to each, and these are hung up in the house. The eggs that are laid the first three days, amounting to about two hundred, alone are kept; they are tied up in a cloth, and suspended to the roof till a few begin to hatch. These eggs are white, and of the size of turnip seed. When a few of the worms are hatched, the cloths are put on small bamboo platters hung up in the house, in which they are fed with tender leaves. After the second moulting, they are removed to bunches of leaves suspended above the ground, beneath which a mat is laid to receive them when they fall. When they cease to feed, they are thrown into baskets full of dry leaves, among which they form their cocoons, two or three being often found joined together. Upon this injudicious practice I have already animadverted.

9. The *Saturnia trifenestrata* has a yellow cocoon of a remarkably silky lustre. It lives on

the soom tree in Assam, but seems not to be much used.

SILK FILATURE.

The mechanism of the silk filature, as lately improved in France, is very ingenious. *Figs.* 1 and 2 exhibit it in plan and longitudinal view.

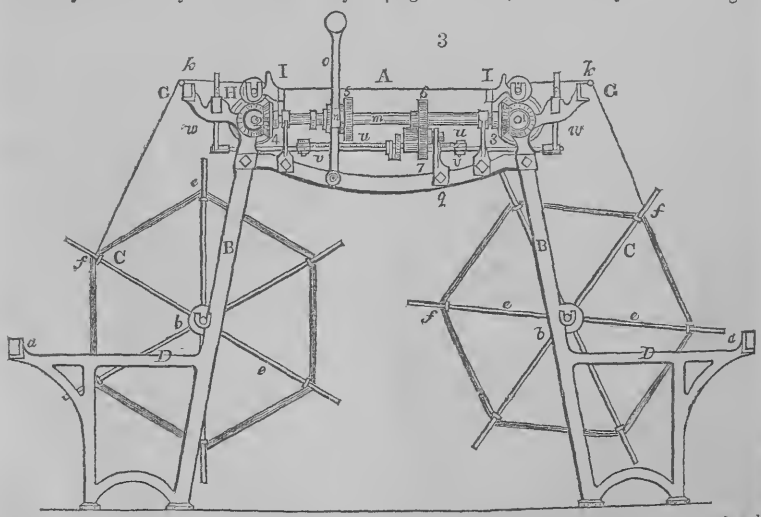


a is an oblong copper basin containing water heated by a stove or by steam. It is usually divided by transverse partitions into several compartments, containing twenty cocoons, of which there are five in one group, as shown in the figure. *b, b,* are wires with hooks or eyelets at their ends, through which the filaments run, apart, and are kept from ravelling. *c, c,* the points where the filaments cross and rub each other, on purpose to clean their surfaces. *d,* is a spiral groove, working upon a pin point, to give the traverse motion alternately to right and left, whereby the thread is spread evenly over the surface of the reel *e*. *f, f,* are the pulleys, which by means of cords transmit the rotary movement of the cylinder *d*, to the reel *e*. *g,* is a friction lever or tumbler, for lightening or slackening the endless cord, in the act of starting or stopping the winding operation. Every apartment of a large filature contains usually a series of such reels as the above, all driven by one prime mover; each of which, however, may by means of the tumbling lever be stopped at pleasure. The reeler is careful to remove any slight adhesions, by the application of a brush in the progress of her work.

The raw silk, as imported into England in hanks from the filatures, requires to be regularly wound upon bobbins, doubled, twisted, and reeled in silk mills. These processes are called *throwing* silk, and their proprietors are called silk *throwsters;* terms probably derived from the appearance of swinging or tossing which the silk threads exhibit during their rapid movements among the machinery of the mills.

SILK-THROWING MILL.

The first process to which the silk is subjected, is winding the skeins, as imported, off upon bobbins. The mechanism which effects this winding off and on, is technically called the *engine,*



or swift. The bobbins to which the silk is transferred, are wooden cylinders, of such thickness as may not injure the silk by sudden flexure, and which may also receive a great length of thread without having their diameter materially increased, or their surface velocity changed. *Fig.* 3

is an end view of the silk throwing machine, or *engine*, in which the two hexagonal reels, called swifts, are seen in section, as well as the table between them, to which the bobbins and impelling mechanism are attached. The skeins are put upon these reels, from which the silk is gradually unwound by the traction of the revolving bobbins. One principal object of attention, is to distribute the thread over the length of the bobbin-cylinder in a spiral or oblique direction, so that the end of the slender semi-transparent thread may be readily found when it breaks. As the bobbins revolve with uniform velocity, they would soon wind on too fast, were their diameters so small at first as to become greatly thicker when they are filled. They are therefore made large, are not covered thick, but are frequently changed. The motion is communicated to that end of the engine shown in the figure.

The wooden table A, shown here in cross section, is sometimes of great length, extending twenty feet, or more, according to the size of the apartment. Upon this the skeins are laid out. It is supported by the two strong slanting legs B, B, to which the bearings of the light reel C are made fast. These reels are called *swifts*, apparently by the same etymological casuistry as *lucus à non lucendo;* for they turn with reluctant and irregular slowness; yet they do their work much quicker than any of the old apparatus, and in this respect may deserve their name. At every eighth or tenth leg there is a projecting horizontal piece D, which carries at its end another horizontal bar *a*, called the knee rail, at right angles to the former. This protects the slender reels or swifts from the knees of the operatives.

The expense of reeling the excellent Cevennes silk is only three francs and fifty centimes per Alais pound; from four to five cocoons going to one thread. That pound is ninety-two hundreths of our avoirdupois pound. In Italy, the cost of reeling silk is much higher, being seven Italian livres per pound, when three to four cocoons go to the formation of one thread; and six livres when there are from four to five cocoons. The first of these raw silks will have a *titre* of twenty to twenty-four deniers; the last, of twenty-four to twenty-eight. If five to six cocoons go to one thread, the titre will be from twenty-six to thirty-two deniers, according to the quality of the cocoons. The Italian livre is worth 7½d. English. The woman employed at the kettle receives one livre and five sous per day; and the girl who turns the reel, gets thirteen sous a day; both receiving board and lodging in addition. In June, July and August, they work sixteen hours a day, and then they wind a *rubo* or ten pounds weight of cocoons, which yield from one-fifth to one-sixth of silk, when the quality is good. The whole expenses amount to from six to seven livres upon every ten pounds of cocoons; which is about 2s. 8d. per English pound of raw silk.

These swifts have a strong wooden shaft *b*, with an iron axis passing longitudinally through it, round which they revolve, in brass bearings fixed near to the middle of the legs B. Upon the middle of the shaft *b*, a loose ring is hung, shown under *c*, in *fig.* 4, to which a light weight *d*, is suspended, for imparting friction to the reel, and thus preventing it from turning round, unless it be drawn with a gentle force, such as the traction of the thread in the act of winding upon the bobbin.

Fig. 4 is a front view of the engine. B, B, are

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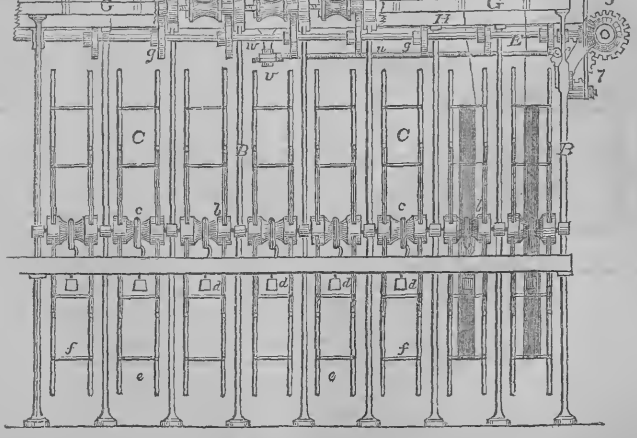
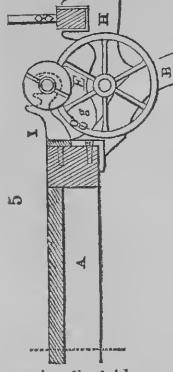


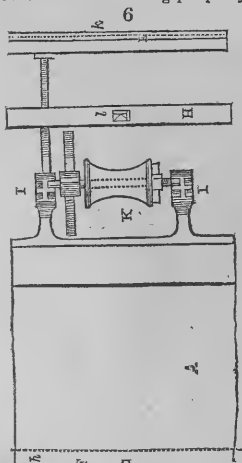
the legs, placed at their appropriate distances (scale one and a half inch to the foot); C, C, are the swifts. By comparing *figs.* 3 and 4, the structure of the swifts will be fully understood.

From the wooden shaft *b*, six slender wooden (or iron) spokes *e*, *e*, proceed, at equal angles to each other; which are bound together by a cord *f*, near their free ends, upon the transverse line *f*, of

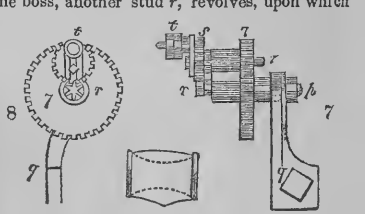
which cord, the silk thread is wound, in a hexagonal form; due tension being given to the circumferential cords, by sliding them out from the centre. Slender wooden rods are set between each pair of spokes, to stay them, and to keep the cord tight. E is one of the two horizontal shafts, placed upon each side of the *engine* to which are affixed a number of light iron pulleys *g*, *g*, (shown on a double scale in *fig.* 5). These serve, by friction, to drive the bobbins which rest upon their peripheries.

To the table A, *fig.* 3, are screwed the light cast-iron slot-bearings I, I, wherein the horizontal spindles or skewers rest, upon which the bobbins revolve. The spindles (see F, *fig.* 9) carry upon one end a little wooden pulley *h*, whereby they press and revolve upon the larger driving pulleys *g*, of the shaft E. These pulleys are called *stars* by our workmen. The other ends of the spindles, or skewers, are cut into screws, for attaching the swivel nuts *i* (*fig.* 9), by which the bobbins K, K, are made fast to their respective spindles. Besides the slots above described, in which the spindles rest when their friction pulleys *h*, are in contact with the moving stars *g*, there is another set of slots in the bearings, into which the ends of the spindles may be occasionally laid, so as to be above the line of contact of the rubbing periphery of the star *g*, in case the thread of any bobbin breaks. Whenever the girl has mended the thread, she replaces the bobbin-spindle in its deeper slot-bearings, thereby bringing its pulley once more into contact with the star, and causing it to revolve. G is a long ruler or bar of wood, which is supported upon every eighth or twelfth leg B, B. (The figure being for the convenience of the page contracted in length, shows it at every sixth leg.) To the edge of that bar the smooth glass rods *k*, are made fast, over which the threads glide from the swifts, in their way to the bobbins. H is the guide bar, which has a slow traverse or seesaw motion, sliding in slots at the top of the legs B, where they support the bars G. Upon the guide bar H, the guide pieces *l*, *l*, are made fast. These consist of two narrow, thin, upright plates of iron, placed endwise together, their contiguous edges being smooth, parallel, and capable of approximation to any degree by a screw, so as to increase or diminish at pleasure the ordinary width of the vertical slit that separates them. Through this slit the silk thread must pass, and, if rough or knotty, will be either cleaned or broken; in the latter case, it is neatly mended by the attendant girl.





The motions of the various parts of the *engine* are given as follows: Upon the end of the machine, represented in *fig.* 3, there are attached to the shafts E, (*fig.* 4,) the bevel wheels 1 and 2, which are set in motion by the bevel wheels 3 and 4, respectively. These latter wheels are fixed upon the shaft *m*, *fig.* 3. *m*, is moved by the main stem shaft which runs parallel to it, and at the same height, through the length of the *engine* apartment, so as to drive the whole range of the machines. 5, is a loose wheel or pulley upon the shaft *m*, working in gear with a wheel upon the steam shaft, and which may be connected by the clutch *n*, through the hand lever or gearing rod *o*, (*figs.* 3 and 4,) when the engine is to be set at work. 6, is a spur wheel upon the shaft *m*, by which the stud wheel 7 is driven, in order to give the traverse motion to the guide bar H. This wheel is represented, with its appendages, in double size *figs.* 7 and 8, with its boss upon a stud *p*, secured to the bracket *q*. In an eccentric hole of the same boss, another stud *r*, revolves, upon which

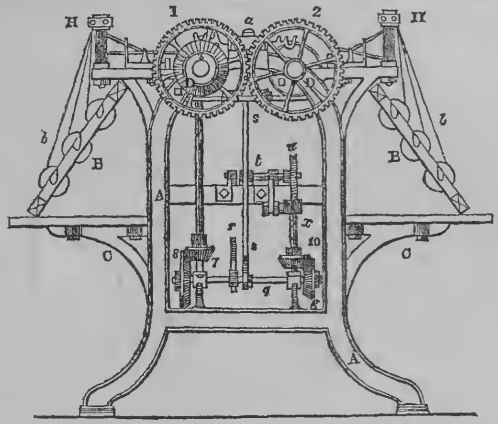


the little wheel *s* is fixed. This wheel *s*, is in gear with a pinion cut upon the end of the fixed stud *p*; and upon it is screwed the little crank *t*, whose collar is connected by two rods *u*, (*figs.* 3 and 4,) to a cross-piece *v*, which unites the two arms *w*, that are fixed upon the guide bar H, on both sides of the machine. By the revolution of the wheel 7, the wheel *s* will cause the pinion of the fixed stud *p* to turn round. If that wheel bear to the pinion the proportion of 4 to 1, then the wheel *s* will make, at each revolution of the wheel 7, one-fourth of a revolution; whereby the crank *t* will also rotate through one-fourth of a turn, so as to be brought nearer to the centre of the stud, and to draw the guide bar so much less to one side of its mean position. At the next revolution of the wheel 7, the crank *t* will move through another quadrant, and come still nearer to the central position, drawing the guide bars still less aside, and therefore causing the bobbins to wind on more thread in their middle than to-

wards their ends. The contrary effect would ensue, were the guide bars moved by a single or simple crank. After four revolutions of the wheel 7, the crank *t* will stand once more as shown in *fig.* 8, having moved the bar H through the whole extent of its traverse. The bobbins, when filled, have the appearance represented in *fig.* 10; the thread having been laid on them all the time in diagonal lines, so as never to coincide with each other.

Doubling is the next operation of the silk throwster. In this process, the threads of two or three of the bobbins, filled as above, are wound together in contact upon a single bobbin. An ingenious device is here employed to stop the winding-on the moment one of these parallel threads happens to break. Instead of the swifts or reels, a creel is here mounted for receiving the bobbins from the former machine, two or three being placed in one line over each other, according as the threads are to be doubled or trebled.—Though this machine is in many respects like the *engine*, it has some additional parts, whereby the bobbins are set at rest, as above mentioned, when one of the doubling threads gets broken.

Fig. 11, is an end view, from which it will be

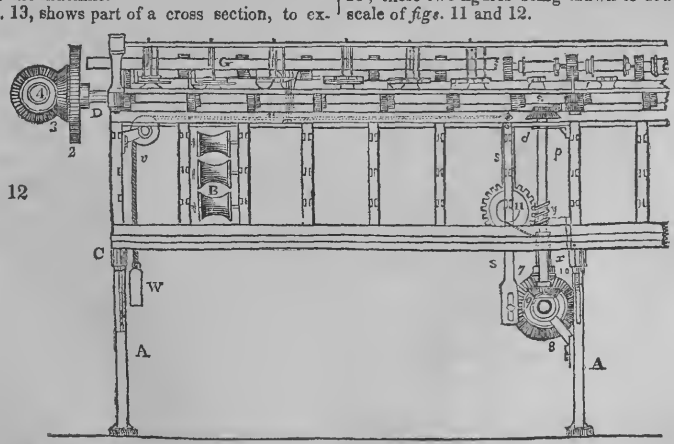


perceived that the machine is, like the preceding, a double one, with two working sides.

Fig. 12, is a front view of a considerable portion of the machine.

Fig. 13, shows part of a cross section, to explain minutely the mode of winding upon a single bobbin.

Fig. 14, is the plan of the parts shown in *fig.* 13; these two figures being drawn to double the scale of *figs.* 11 and 12.



A, A, *figs.* 11 and 12, are the end frames, connected at their tops by a wooden stretcher, or *barbeam*, *a*, which extends through the whole length of the machine; this bar is shown also in *figs.* 13 and 14.

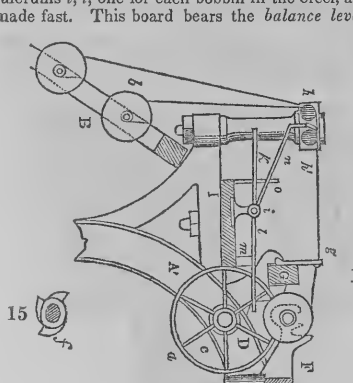
B, B, are the creels upon each side of the machine, or bobbin bearers, resting upon wooden beams or boards, made fast to the arms or brackets C, about the middle of the frames A.

D, D, are two horizontal iron shafts, which per-

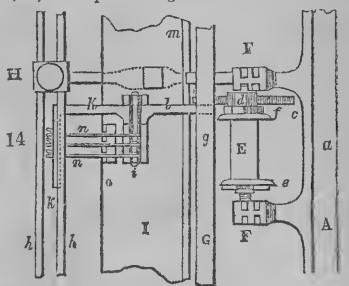
vade the whole machine, and carry a series of light moveable pulleys, called *stars*, *c*, *c*, (*figs.* 13, 14,) which serve to drive the bobbins E, E, whose fixed pulleys rest upon their peripheries, and are therefore turned simply by friction. These bobbins are screwed by swivel nuts *e*, *e*, upon spindles, as in the silk engine. Besides the small friction pulley or boss, *d*, seen best in *fig.* 14, by which they rest upon the star pulleys *c*, *c*, a little ratchet wheel *f*, is attached to the other end of each bobbin. This is also shown by itself at *f*, in *fig.* 15.

The spindles with their bobbins revolve in two slot-bearings F, F, *fig.* 14, screwed to the bar-beam *a*, which is supported by two or three intermediate upright frames, such as A'. The slot-bearings F, have also a second slot, in which the spindle with the bobbin is laid at rest, out of contact of the *star* wheel, while its broken thread is being mended. G, is the guide bar, (to which the cleaner slit piece *g*, *g*, are attached,) for making the thread traverse to the right and the left, for its proper distribution over the surface of the bobbin. The guide bar of the doubling machine is moved with a slower traverse than in the engine. otherwise, in consequence of the different obliquities of the paths, the single threads would be readily broken. *h*, *h*, is a pair of smooth rods of iron or brass, placed parallel to each of the two sides of the machine, and made fast to the standards H, H, which are screwed to brackets projecting from the frames A, A'. Over these rods the silk threads glide, in their passage to the guide wires *g*, *g*, and the bobbins E, E.

I, I, is the *lever board* upon each side of the machine, upon which the slight brass bearings or fulcrums *i*, *i*, one for each bobbin in the creel, are made fast. This board bears the *balance lever*



k, *l*, with the *fallers n*, *n*, *n*, which act as dexterous fingers, and stop the bobbin from winding-on the instant a thread may chance to break. The levers *k*, *l*, swing upon a fine wire axis, which passes through their props *i*, *i*, their arms being shaped rectangularly, as shown at *k*, *k'*. *fig.* 14. The arm *l*, being heavier than the arm *k*, naturally rests upon the ridge bar *m*, of the lever board I. *n*, *n*, *n*, are three wires, resting at one of their ends upon the axis of the fulcrum *i*, *i*, and having each of their other hooked ends suspended by one of the silk threads, as it passes over the front steel rod *h*, and under *h'*. These faller wires, or stop fingers, are guided truly in their up-and-down motions with the thread, by a cleaner-plate *o*, having a vertical slit in its middle. Hence, whenever any thread happens to break, in its way to a winding-on bobbin E, the wire *n*, which hung by its eyelet end to that thread, as it passed through between the steel rods in the line of *h*, *h'*, falls upon the lighter arm of the balance



lever *k*, *l*, weighs down that arm *k*, consequently jerks up the arm *l*, which pitches its tip or end into one of the three notches of the ratchet or catch wheel *f* (*figs.* 14 and 15) fixed to the end of the bobbin. Thus its motion is instantaneously arrested, till the girl has had leisure to mend the thread, when she again hangs up the faller wire *n*, and restores the lever *k*, *l*, to its horizontal position. If, meanwhile, she took occasion to remove the winding bobbin out of the sunk slot-bearing, where the pulley *d* touches the *star* wheel *c*, into the right hand upper slot of repose, she must now shift it into its slot of rotation.

The motions are given to the doubling machine in a very simple way. Upon the end of the framing, represented in *fig.* 11, the shafts D, D, bear two spur wheels 1 and 2, which work into each other. To the wheel 1, is attached the bevel wheel 3, driven by another bevel wheel 4, (*fig.* 12,) fixed to a shaft that extends the whole length of the apartment, and serves, therefore, to drive a whole range of machines. The wheel 4 may be put in gear with the shaft, by clutch and gear-handle, as in the silk *engine*, and thereby it drives two shafts, by the one transmitting its movement to the other.

The traverse motion of the guide bar G, is effected as follows:—Upon one of the shafts D, there is a bevel wheel 5, driving the bevel wheel 6, upon the top of the upright shaft *p*, (*fig.* 12, to the right of the middle;) whence the motion is transmitted to the horizontal shaft *q*, below, by means of the bevel wheels 7 and 8. Upon this shaft *q*, there is a heart-wheel *r*, working against a roller whish is fixed to the end of the lever *s*, whose fulcrum is at *t*, *fig.* 12. The other end of the lever *s*, is connected by two rods (shown by dotted lines in *fig.* 12) to a brass piece which joins the arms *u* (*fig.* 12) of the guide bars G. To the same cross piece a cord is attached, which goes

over a roller v, and suspends a weight w, by means of which the level s, is pressed into contact with the heart-wheel r. The fulcrum t, of the lever s, is a shaft which is turned somewhat eccentric, and has a very slow rotatory motion. Thus the guide bar, after each traverse, necessarily winds the silk in variable lines, to the side of the preceding threads.

The motion is given to this shaft in the following way: Upon the horizontal shaft q, there is a bevel wheel g, (*figs.* 11 and 12,) which drives the wheel 10 upon the shaft x; on whose upper end, the worm y works in the wheel 11, made fast to the said eccentric shaft t; round which the lever s swings or oscillates, causing the guide bars to traverse.

THE SPINNING SILK-MILL.

The machine which twists the silk threads, either in their single or doubled state, is called the spinning mill. When the raw singles are first twisted in one direction, next doubled, and then twisted together in the opposite direction, an exceedingly wiry, compact thread, is produced, called *organzine*. In the spinning mill, either the singles or the doubled silk, while being unwound from one set of bobbins, and wound upon another set, is subjected to a regular twisting operation; in which process the thread is conducted as usual through guides, and coiled diagonally upon the bobbins by a proper mechanism.

Fig. 16, exhibits an end view of the spinning mill, in which four working lines are shown; two tiers upon each side, one upon the other. Some spinning mills have three working tiers upon each side; but as the highest tier must be reached by a ladder or platform, this construction is considered by many to be injudicious.

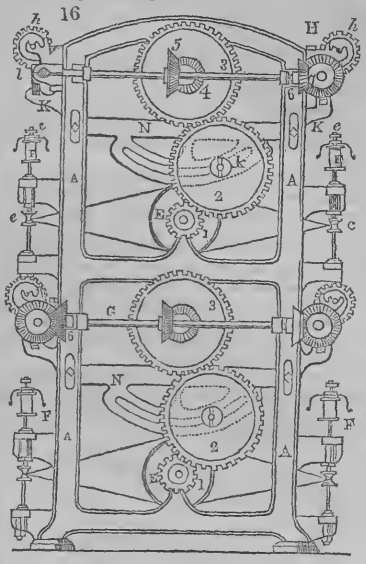


Fig. 17 is a front view, where, as in the former figure, the two working lines are shown.

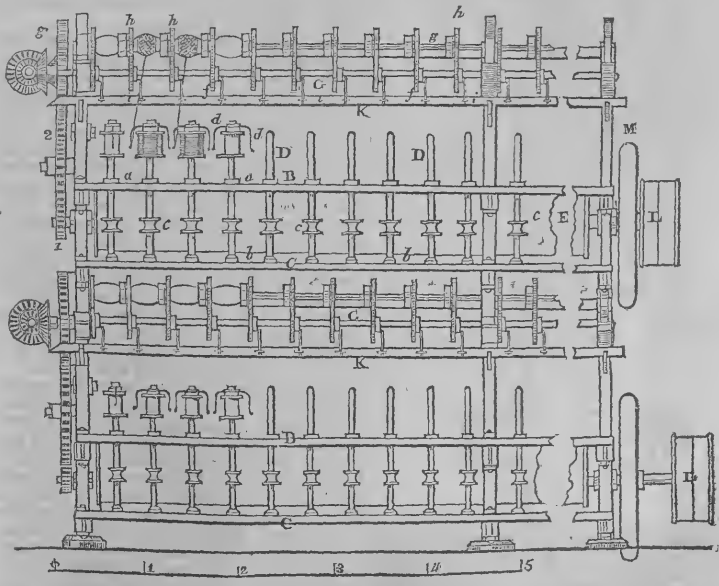


Fig. 18, is a cross section of a part of the machine, to illustrate the construction and play of the working parts; *figs.* 24, 25, are other views of *fig.* 18.

Fig. 19, shows a single part of the machine, by which the bobbins are made to revolve.

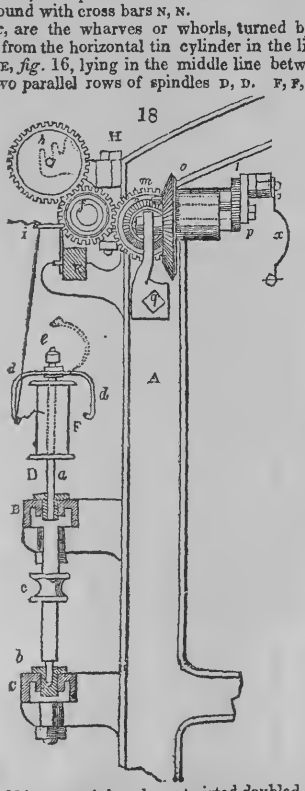
Figs. 20, and 21, show a different mode of giving the traverse to the guide bars, than that represented in *fig.* 18.

Figs. 22, and 23, show the shape of the full bobbins, produced by the action of these two different traverse motions.

The upper part of the machine being exactly the same as the under part, it will be sufficient to explain the construction and operation of one of them.

A, A, are the end upright frames or standards, between which are two or three intermediate standards, according to the length of the machine. They are all connected at their side by beams B and C, which extend the whole length of the machines. D, D, are the spindles, whose top bearings, *a*, *a*, are made fast to the beams B, and their bottoms turn in hard brass steps, fixed to the bar C. These two bars together are called, by the workmen, the spindle box. The standards A, A, are bound with cross bars N, N.

c, *c*, are the wharves or whorls, turned by a band from the horizontal tin cylinder in the lines of E, E, *fig.* 16, lying in the middle line between the two parallel rows of spindles D, D. F, F, are



the bobbins containing the untwisted doubled silk, which are simply pressed down upon the taper end of the spindles. *d*, *d*, are little fliers, or forked wings of wire, attached to washers of wood, which revolve loose upon the tops of the said bobbins F, and round the spindles. One of the wings is sometimes bent upwards, to serve as a guide to the silk, as shown by dotted lines in *fig.* 18. *e*, *e*, are pieces of wood pressed upon the tops of the spindles, to prevent the fliers from starting off by the centrifugal force. G, are horizontal shafts bearing a number of little spur wheels *f*, *f*. H, are slot-bearings, similar to those of the doubling-machine, which are fixed to the end and middle frames. In these slots, the light square cast-iron shafts or spindles *g*, *fig.* 17, are laid, on whose end the spur wheel *h* is cast; and when the shaft *g* lies in the front slot of its bearing, it is in gear with the wheel *f*, upon the shaft G; but when it is laid in the back slot, it is out of gear, and at rest. See F, F, *fig.* 14.

Upon these little cast-iron shafts or spindles *g*, *fig.* 19, the bobbins or blocks I, are thrust, for receiving, by winding-on, the twisted or spun silk. These blocks are made of a large diameter, in order that the silk fibres may not be too much bent, and they are but slightly filled, at each successive charge, lest, by increasing their diameter too much, they should produce too rapid an increase in the rate of winding, with proportional diminution in the twist, and risk of stretching or tearing the silk. They are, therefore, the more frequently changed. K, K, are the guide bars, with the guides *i*, *i*, through which the silk passes, being drawn by the revolving bobbins I, and delivered or laid on the fliers *d*, *d*, from the rotatory twisting bobbins F. The operation of the machine is therefore simple, and the motions are given to the parts in a manner equally so.

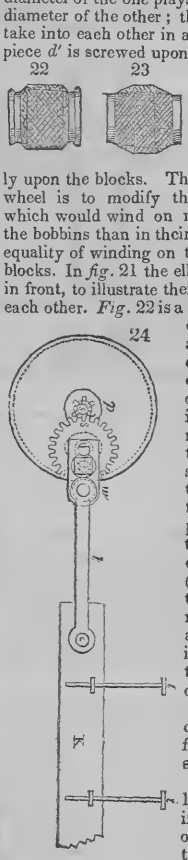
Upon the shaft of the tin cylinder or drum, exterior to the frame, the usual fast and loose pulleys, or riggers, L, L', are mounted, for driving the whole machine. These riggers are often called steam pulleys by the workmen, from their being connected by bands with the steam-driven shaft of the factory. In order to allow the riggers upon the shafts of the upper and the under drums to be driven from the same pulley upon the main shaft, the axis of the under drum is prolonged at L, L', and supported at its end, directly from the floor, by an upright bearing. Upon the shafts of the tin cylinders there is also a fly-wheel M, to equalize the motion. Upon the other ends of these shafts, namely, at the end of the spinning-mill, represented in *fig.* 16, the pinions 1, are fixed, which drive the wheels 3, by means of the intermediate or carrier wheel 2; called also the plate-wheel, from its being hollowed somewhat like a trencher. 1, is called the change-pinion, because it is changed for another, of a different size and different number of teeth, when a change in the velocity of wheels 2 and 3 is to be made. To allow a greater or smaller pinion to be applied at 1, the wheel 2 is mounted upon a stud *k*, which is moveable in a slot concentric with the axis of the wheel 3. This slot is a branch from the cross-bar N. The smaller the change-pinion is, the nearer will the stud *k* approach to the vertical line joining the centres of wheels 1 and 3; and the more slowly will the plate wheel 2, be driven. To the spur wheel 3, a bevel wheel 4, is fixed, with which the other also revolves loose upon the stud. The bevel wheel 5, upon the shaft *l*, is driven by the bevel wheel 4; and it communicates motion, by the bevel wheels 6 and 7, to each

of the horizontal shafts G, G, extending along the upper and under tiers of the machine. At the left-hand side of the top part of *fig.* 16, the two wheels 6 and 7 are omitted, on purpose to show the bearings of the shaft G, as also the slot-bearings for carrying the shafts or skewers of the bobbins.

If it be desired to communicate twist in the opposite direction to that which would be given by the actual arrangement of the wheels, it is necessary merely to transpose the carrier wheel 2, from its present position on the right hand of pinion 1, to the left of it, and to drive the tin cylinder by a crossed or close strap, instead of a straight or open one.

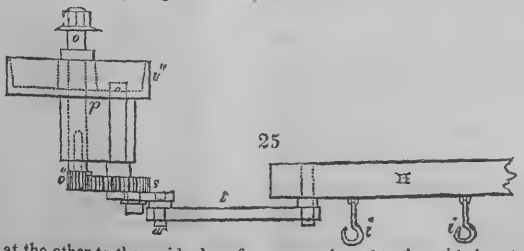
The traverse motion of the guide is given here in a similar way to that of the engine, (*fig.* 3.) Near one of the middle or cross-frames of the machine (see *fig.* 18) the wheel *f*, in gear with a spur wheel *h*, upon one of the block-shafts, drives also a spur wheel *m*, that revolves upon a stud, to which wheel is fixed a bevel wheel *n*, in gear with the bevel wheel *o*. To wheel *o*, the same mechanism is attached as was described under *figs.* 7 and 8, and which is here marked with the same letters.

To the crank-knob *r*, *fig.* 18, a rod *x*, is attached, which moves or traverses the guide bar belonging to that part of the machine; to each machine one such apparatus is fitted. In *figs.* 20 and 21 another mode of traversing the guide bar is shown, which is generally used for the coarser qualities of silk. Near to one of the middle frames, one of the wheels *f*, in gear with the spur wheel *m*, and the bevel wheel *n*, both revolving on one stud, gives motion also to the wheel o, fixed upon a shaft *a'*, at whose other end the elliptical wheel *b'* is fixed, which drives a second elliptical wheel *c'*, in such a way that the larger diameter of the one plays in gear with the smaller diameter of the other; the teeth being so cut as to take into each other in all positions. The crank-piece *d'* is screwed upon the face of the wheel *c'*, at such a distance from its centre as may be necessary to give the desired length of traverse motion to the guide bar for laying the silk spirally upon the blocks. The purpose of the elliptical wheel is to modify the simple crank motion, which would wind on more silk at the ends of the bobbins than in their middle, and to effect an equality of winding on the whole surface of the blocks. In *fig.* 21 the elliptical wheels are shown in front, to illustrate their mode of operating upon each other. *Fig.* 22 is a block filled by the motion of the eccentric, *fig.* 18; and *fig.* 23 is a block filled by the elliptical mechanism. As the length of the motions of the bar in the latter construction remains the same during the whole operation, the silk, as it is wound on the blocks, will slide over the edges, and thereby produce the flat ends of the barrel in *fig.* 23. The conical ends of the block (*fig.* 22) are produced by the continually shortened motions of the guide bar, as the stud approaches, in its sun-and-planet rotation, nearer to the general centre.



Figs. 24, 25, are two different views of the differential mechanism described under *fig.* 18.

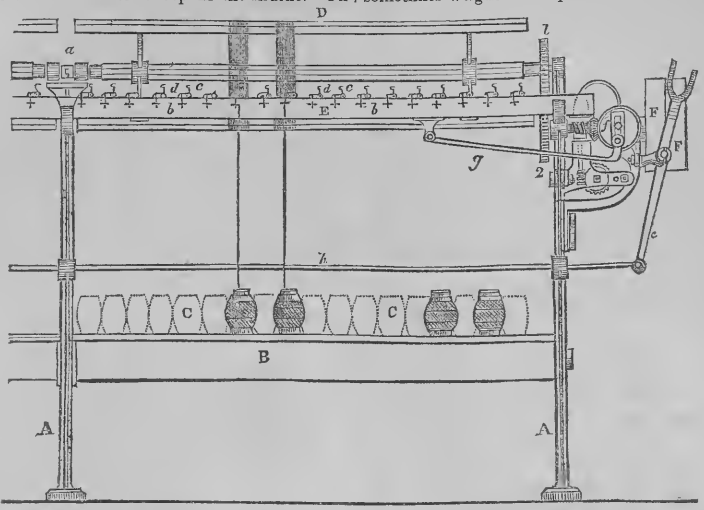
The bent wire *x*, *fig.* 18, is called the guider iron. It is attached at one end to the pivot of the sun-and-planet wheel-work *t*, *s*, *o*, and at the other to the guide bar *f*, *f*, *fig.* 17. The silk threads pass through the guides, as already explained. By the motion communicated to the guide bar, (*guider,*) the diamond pattern is produced, as shown in *fig.* 22.



THE SILK AUTOMATIC REEL.

In this machine, the silk is unwound from the blocks of the throwing-mill, and formed into hanks for the market. The blocks being of a large size, would be productive of much friction, if made to revolve upon skewers thrust through them, and would cause frequent breakage of the silk. They are, therefore, set with their axes upright upon a board, and the silk is drawn from their surface, just as a weft is from a cop in the shuttle. On this account the previous winding-on must be executed in a very regular manner: and preferably as represented in *fig.* 22.

Fig. 22 is a front view of the reel; little more than one-half of it being shown. *Fig.* 27 is an end view. Here the steam pulleys are omitted, for fear of obstructing the view of the more essential parts. A, A, are the two end framings, connected by mahogany stretchers, which form the table B, for receiving the bobbins C, C, which are sometimes weighted at top with a lump of lead,



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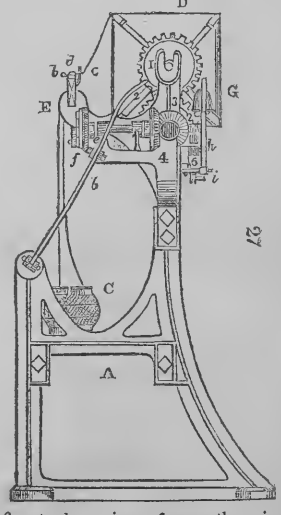
to prevent their tumbling. D, is the reel, consisting of four long laths of wood, which are fixed upon iron frames, attached to an octagonal wooden shaft. The arm which sustains one of these laths is capable of being bent inwards, by loosening a tightening hook, so as to permit the hanks, when finished, to be taken off, as in every common reel.

The machine consists of two equal parts, coupled together at *a*, to facilitate the removal of the silk from either half of the reel; the attendant first lifting the one part, and then the other. E, is the guide bar, which by a traverse motion causes the silk to be wound on in a cross direction. *b*, and *c*, are the wire guides, and *d*, are little levers lying upon the cloth covered guide bar E. The silk, in its way from the block to the reel, passes under these levers, by which it is cleaned from loose fibres.

On the other end of the shaft of the reel, the spur wheel 1 is fixed, which derives motion from wheel 2, attached to the shaft of the steam-pulley F. Upon the same shaft there is a bevel wheel 3, which impels the wheel 4 upon the shaft *e*; to whose end a plate is attached, to which the crank *f* is screwed, in such a way as to give the proper length of traverse motion to the guide bar E, connected to that crank or eccentric stud by the jointed rod *g*. Upon the shaft of the steam-pulleys F, there is a worm or endless screw, to the left of *f*, *fig.* 27, which works in a wheel 5, attached to the short upright shaft *h*, (*fig.* 26.) At the end of *h*, there is another worm, which works in a



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wheel 6; at whose circumference there is a stud

i, which strikes once at every revolution against an arm attached to a bell, seen to the left of *c*; thus announcing to the reel tender that a measured length of silk has been wound upon her reel. *e*, is a rod or handle, by which the fork *l*, with the strap, may be moved upon the fast or loose pulley, so as to set on or arrest the motion at pleasure.

Throwsters submit their silk to scouring and steaming processes. They soak the hanks, as imported, in luke-warm soap-water in a tub; but the bobbins of the twisted single silk from the spinning mill are enclosed within a wooden chest, and exposed to the opening action of steam for about ten minutes. They are then immersed in a cistern of warm water, from which they are transferred to the doubling frame.

There is a peculiar kind of silk called *marabout*, containing generally three threads, made from the white Novi raw silk. From its whiteness, it takes the most lively and delicate colors without the discharge of its gum. After being made into tram by the single twist upon the spinning mill, it is reeled into hanks, and sent to the dyer without further preparation. After being dyed, the throwster re-winds and re-twists it upon the spinning-mill, in order to give it the whipcord hardness which constitutes the peculiar feature of marabout. The cost of the raw Novi silk is 19*s.* 6*d.* a pound; of throwing it into tram, 2*s.* 6*d.*; of dyeing, 2*s.*; of re-winding and re-twisting, after it has been dyed, about 5*s.*; of waste, 2*s.*, or 10 per cent.; the total of which sum is 31*s.*—being the price of one pound of marabout in 1832.

CHAPTER IV.

The Mulberry Tree—Its Varieties and adaptation to the Climate—Comparative Value.

For the following remarks on the Mulberry Tree, we are indebted to Mr. Colman's valuable Report:—

In the silk culture it is perfectly obvious that the tree is matter of primary consideration.—There are several varieties of the Mulberry, on which the worms can be subsisted and made to produce silk, but the trees are of very different values.

The introduction of this extraordinary variety of the Mulberry, the *Morus Multicaulis, or* many stalked Mulberry, or, as I think it should be called after the name of the spirited individual who brought it into Europe, the *Perottet* Mulberry, led to the introduction of other valuable varieties.

1. The Black Mulberry, which is indeed a native of some parts of the country, is of different varieties, and will produce silk, though not equally well; but the silk made from worms fed upon this tree is harsh and coarse. The tree will endure our climate well, but for the reasons above given, it is not an eligible variety.

2. The White Mulberry is not indigenous* in the country; and was imported into Europe centuries ago from Asia, but it has now been for years so widely extended, that it is as familiar as any of our native trees. It is universally conceded that the leaves of the white mulberry are as favorable to the health and growth of the worms, and to the production of silk, both in respect to quantity and quality, as any which is known.—The white mulberry is comparatively a hardy tree, though in severe winters it is generally killed at the extremities of the smaller branches; and in the cold winter of 1834-5, when a great amount of the tender varieties of the apple were destroyed, the white mulberry suffered as severely as other trees. At this time nearly two-thirds of the white mulberry growing in Mansfield, Conn., and, even trees of an advanced age, were utterly destroyed.

[We are informed that this tree is highly valuable for all purposes where the Locust has heretofore stood preëminent. Its remarkable qualities for durability have long been known and appreciated on Long Island.]

Among the white mulberry trees, valuable selections in respect to the size of the leaf may be made with great advantage. Its thriftiness, like that of other plants, depends upon its cultivation, and it is susceptible of great improvement by a careful engrafting of scions from the best kinds, into others of the same species. This mode of improvement has been long practised by European cultivators, and with great success. Among the French, engrafting is considered indispensable.

3. The Broussa mulberry is a variety introduced into the country from Smyrna and Constantinople, and propagated without difficulty from the seed. The leaf of this tree is not larger than that of the white mulberry. Its foliage is very thickly set on the branches; and the leaves are thick and heavy, as well as abundant. They are healthy for the worms. They produce a good silk. They endure the climate of New England without injury. I have not seen trees of this kind of any large size; but those, which I have seen, threw up very numerous branches from the roots, and yielded a large amount of foliage.

4. The Alpine denotes another variety, which has been greatly commended. The designation of this variety, if it is to be called a variety, belongs to this country. Samuel Whitmarsh, of Northampton, who has been prominent in his enterprizing attempts to introduce the culture of silk into the United States, in 1834, visited Italy and France for the purpose of obtaining from the fountain head, and in the most authentic form, the desired information in regard to the silk culture. In visiting in Italy the neighborhood of the Alps, he found there a species of the mulberry, said to have been introduced into that country from China, and called the Chinese mulberry, which was in high repute among the silk growers, and which had proved capable of enduring without injury the rigors of a climate as severe at least as that of New England. He brought a considerable quantity of the seeds to this country, and they have been extensively diffused. It is understood that, from the product of these seeds, he has made abundant selections, which he denominates the Alpine, by which name these trees are now generally known. The results from the planting of this seed have not every where given equal satisfaction, and many contend that they are not superior to the white mulberry. It is not for me to become a party in these disputes.—

* Doubted. I. R. B.

There is little reason to suppose that the trees now called Alpine are an original variety. The leaf is of a large size, generally heart-shaped, but many of them with deep indentures or lobed. They endure the winter well. Of their influence upon the health of the worms, and of the quality of silk, which they produce, I have, as yet, no satisfactory information. I have not been able to hear of any exact experiment in the use of them; excepting a small one, to which I shall presently refer.

5. The PEROTTET MULBERRY, or the MORUS MULTICAULIS, that is, the many stalked mulberry, denotes another variety, of which I have already spoken, and of such pre-eminent notoriety, that it is destined to be immortalized in the history of commercial transactions, if not of agriculture.—This tree was brought from Manilla to France by M. Perottet, in the year 1820; and to this country more than ten years since. It is remarkable for its rapidity of growth, and the shoots which it throws up; and from this circumstance derives its name. Its leaf is plainly distinguishable from other kinds of mulberry leaf. It is heart-shaped, and has a flaccid, loose, and on its upper side a concave appearance, looking as if the ribs of the leaf were not sufficiently spread to allow of the surface to be stretched to its full extent, which gives it the appearance of dried clothes before they are ironed. It hangs vertically upon the branch, and to an inexperienced eye, would appear like a leaf in which the circulation had been arrested. I have seen silk of the finest description made from worms fed upon the leaves of this tree. This silk would not suffer by comparison with any other. The worms devour the leaves of this tree greedily, and as far as it has been tried here, it seems favorable to their health and growth.—The leaf often acquires a large size, though the foliage would naturally be larger while the tree is small, and formed upon recently grown wood, than it would be if the tree were allowed to form a standard tree, and should attain several years' growth. The great advantages, which are relied upon in respect to this tree, are in the rapidity of its growth, the ease with which it can be multiplied, the abundance of its foliage, and the great facility with which the leaves may be gathered.

This tree has been so much the subject of speculation, that it has become matter of no little difficulty to determine what is true in respect to it. Individuals, under the influence of private interest, have indulged in calculations respecting it, so extravagant, that all sobriety seems at once distanced, and we are transported into the upper regions of pure fiction. The extraordinary value of the tree, however, is unquestionable; and the introduction of it into the country, must be considered a distinguished benefaction; but that it is the best tree for the cultivators of silk in New England, is not so well established.

The tree does not appear to be used, certainly it is not preferred, in China. A gentleman in the vicinity of Boston, who had been himself a resident in Canton for many years, and who could command the services and influence of the most intelligent and influential merchants of that city, ordered two thousand of the most valuable tree used in the country, to be shipped to him.—Five hundred of these survived the passage; but the Multicaulis is not among them. The American missionaries, who have sent to this country seeds of the best mulberry which they could procure, did not, it is understood, find the Multicaulis in use in China for the production of silk. The proximity of Manilla, where this tree was found, to Canton, and the constant intercommunication between the two places, would long since have caused the introduction of this tree into China, had it been preferred; but it is understood to have been carried from Canton to Manilla. It is valued, but certainly is not preferred in Italy; nor in Germany, where the silk culture, which was given up about half a century since, is now reviving and strongly urged upon the people on the same grounds of public and private economy, on which it is advocated here.

I take the liberty of subjoining, on this subject, an extract from the private journal of a highly intelligent friend, entirely disinterested in the case, who, with his family, have recently returned from Europe, and who made the silk culture matter of particular but merely incidental inquiry.

"When visiting the botanic garden, at Montpelier, Professor De Lisle gave us his decided opinion against the Morus Multicaulis as food for the silk worm. One of the reasons was that the leaves, in comparison with those of the French mulberry, are thin and weak, and will not bear a single day's wilting without becoming dry and crisp, and unfit for the worm. Although the Multicaulis is prolific, and the leaves are large, still it produces less in weight than the common French, which bears a red or black fruit, grows freely at Montpelier, sending up straight shoots even from old trees that have been topped down, as they generally are there. Of course the leaves are easily gathered by a sweep of the hand along the branches, an object of importance there, and still more so where labor is dear.

"The professor's reasons for condemning the Multicaulis is more important there than elsewhere, because the leaves when gathered are sold by the pound to the worm feeders; and a leaf which lasts good only one day is objectionable. The tender nature of the tree, too, is an objection at Montpelier, because though the climate is milder than in the northern parts of France, the sudden changes from heat to cold in the early spring are too severe; whilst further north the leaves start late, and suffer less in consequence."

The Chevalier Soulange Bodin, one of the highest authorities in Europe, in a recent private letter, speaks of the "Morus Multicaulis as a tree of which much good and much evil has been said—but like other gifts from heaven, it is requisite that it should be managed with discretion, which is also a gift from heaven. The rapidity of its multiplication, the abundant product of its leaves, and the facility of collecting them, have certainly very much contributed, whatever may be the final result, to aid in the happy solution of a great question in agricultural and commercial economy, which has agitated with equal emulation the new as well as the ancient world."

These testimonies are certainly disinterested; and I shall leave them to have what force they may upon the minds of the inquisitive and intelligent. It is certain that the tree is not capable of enduring the rigors of our climate, under our

present modes of cultivation. In this state it has been repeatedly killed, and in this way great losses have been sustained. I do not despair, however, of its being acclimated here. The peach in its origin, is a tender plant from southern Asia; and as that is now sufficiently sure to warrant its cultivation, we may hope that the Perottet mulberry may in like manner become a denizen of our soil. The plant is, in itself, after all reasonable abatements are made, of such extraordinary value, that every inquiry and effort should be made, by which its security might be accomplished.

The hazard of its destruction is not in proportion to the intensity of the cold. The season of greatest danger seems to be at the first coming of frosts. Then if the growth is luxuriant and the wood has not become matured, it perishes with the cold. Attempts have been made to preserve it by cutting the shoots near the ground in the autumn, and then covering the root with earth; this has not succeeded to secure them. Yet there are well authenticated cases in which the trees have been taken up, and then deposited under a wall with the roots merely covered with earth, and they have survived the winter well. This was done in Manchester, Conn. On the same farm, an attempt was made by cutting off the shoots and leaving the roots in the ground, with out covering, to test their hardiness. It was unsuccessful. The farmer attributed their loss, in a degree, to a heavy rain immediately after they were topped, by which he supposed the cut ends became saturated with water, which was followed by a severe frost. The fact of their destruction was undoubted.

John Macomber, in Westport, Bristol county, whose nursery I visited, reports, that in the cold year of 1835–6, about one-half of his Perottet mulberry survived the winter; and of those which were engrafted upon the white mulberry, not more than eight out of a hundred perished.

William Kenrick, of Newton, near Boston, whose experience and skill as a nursery man are well known, in a recent private letter to me, says —"I have several trees of the Morus Multicaulis standing on Nonantum Hill, in an elevated and bleak situation, trees now of considerable size, which, unprotected, have borne well the severity of our late winters. In March, of this present year, two gentlemen of Windham county, Conn., called and desired to look at my trees, and brought me in a twig cut from the top of one of the trees, which had ripened to the very tip, and had stood the last most severe cold winter uninjured. Yet I have since discovered that in some parts of the tops of these same trees, some of the young wood did not wholly escape uninjured.—Yet in all the low valleys of the northern rivers which have their sources near the boundaries of Canada, and in the low and extended plains of New England, the Multicaulis is liable to be injured in its tops by the extreme severity of the winter. In spring they rise up with a luxuriance of vegetation the most extraordinary. Hence the mulberry should be kept low like a plantation of raspberries, as is the case in China and in India. In this last named country, the mulberry tree, in all its varieties, is an ever-green tree, but a deciduous tree in temperate regions. This same system is now extending itself in France, as has already the system of close planting and of low training, been adopted almost universally as to the vine in vineyard culture, in all the north and middle sections of that country."

Mr. Kenrick adds, "In my frequent visits to Portsmouth, in lower Virginia, in lat. 37 deg. 12 min., in the years 1838 and 1839, both during winter and summer, I have particularly observed extensive plantations; the trees at that place, in their hardihood, bearing perfect resemblance to the oak, the wood of the second year ripening to the very tip. At Middletown, in Monmouth county, N. J., lat. 40 deg. 22 min., this same mulberry equally defies the severity of all their winters. This is nearly opposite Staten Island."

"The Morus Multicaulis is the only species of mulberry known which grows equally as freely from the cuttings as the willow. The variety called Canton roots not near so freely either from cuttings or from layers, while the Alpine, so called, is still more difficult to strike root, either from cuttings or layers."

Mr. Kenrick has been a highly successful cultivator and seller of the Perottet mulberry. His character, where he is known, is a guaranty against any intentional misrepresentation on his part. His good fortune in the sale of his trees has enabled him, if so he pleases, to change the plain steel bows of his spectacles into golden ones; but whether it has had any effect upon the glasses themselves, we must submit to the judgment of others.

The Northampton cultivators, as far as I know, universally, and Timothy Smith, of Amherst—upon whose careful judgment and experience much reliance may be placed, as well as Calvin Haskell, of Harvard, who has been a long time engaged in the cultivation of the mulberry—unite emphatically, in the opinion that the Perottet is not sufficiently hardy for our climate; and to cultivate it with any view to leave it exposed to the rigors of our climate would be a hazardous, and in all probability an utterly futile attempt. The testimony of many other cultivators of the Perottet mulberry, in this State, entirely concur in the opinions expressed above.

With respect to the value of the Multicaulis leaf as feed for the worms, D. McLean, of New Jersey, expresses the opinion that it may be too succulent for the health of the worms; though it does not appear that the worms fed by him on the Multicaulis or Perottet mulberry suffered in this way. This is the opinion of other cultivators of silk; but farther experiments are desired before this point can be established.

Miss Gertrude Rapp, of Economy, Penn., in a letter to the editor of the American Silk Journal, says:—

"In regard to the mulberry, I would earnestly recommend, especially to the silk growers of the northern and middle states, not to neglect the cultivation of the white Italian or a similar mulberry tree, as by raising the Multicaulis only, the best crops (which are produced in the fore part of the summer) are lost. The Multicaulis is a most excellent addition to, but not a perfect substitute for, the other kinds. They ought to go together. Several years ago, we received among other kinds a kind of mulberry under the double name of *morus broussa or expansa*, which we now endeavor

to multiply (by grafting) as fast as possible, as it possesses all the excellent qualities of the Italian, besides having large, heavy, glossy leaves, which are gathered with less than half the labor of the white Italian. Such silk growers as possess this kind, would undoubtedly do well to propagate it as fast as possible along with the Multicaulis."

Miss Rapp's authority on this subject is as high as any in the country. The *morus broussa* and the *morus expansa*, or Roman mulberry, which have come under my observation, are quite different varieties.

Among us in general, the Perottet mulberry has been cultivated in low, moist, and rich soils, in which case the growth is continued until very late in the season, and the wood is not sufficiently matured to withstand the frost. If placed, however, in situations less favorable to a luxuriant growth, and to the thriftiness of the tree, the size of the leaf and amount of foliage will of course be lessened.

It is somewhat difficult, in respect to the hardiness of this plant, to reconcile these conflicting testimonies, and I shall not attempt to do it.—Without impugning, in any measure, the credit of any, however different the results to which they come, we may refer these different results to differences in aspect, soil, location, and cultivation; and encourage the hope that presently the tree may become naturalized and safe among us.

The weight of evidence, however, upon as fair a review of the case as I can take, and from my own extended personal observation, is altogether against its suitableness at present in a permanent plantation for the climate of Massachusetts. I shall speak presently of other modes of managing with it, by which the signal advantages which it proffers may be realized.

[The above was written in February, 1840, at which time the amount of experience in regard to the ability of the Multicaulis to endure our northern winters was very limited. Subsequent experience has taught us that they are as safe in Massachusetts as in Virginia; and, when rightly managed, are essentially safe any where. It is not the *degree* of cold that does the injury in this and similar cases, but *sudden* freezing and thawing. The tree should be set on warm, dry corn land, in a good state of fertility, the roots set deep, and the ground ridged in the process of summer cultivation, *especially* if the field is a dead level. If the water in the winter is allowed to stand around them, it will kill them. The ground should be rich enough to secure a good extended root the first season. Managed in this way, they are essentially safe any where between Canada and the Gulf of Mexico. Not managed thus, they are in danger any where, where it is cold enough for ice to form, and the ground to freeze. The unripe ends of the limbs and main stem also may, or may not be affected. But this is of no consequence, as we wish to take the brush all off in the spring, or in the process of summer feeding. All these remarks apply to the Canton mulberry with equal force, so far as my experience and observation can testify.] I. R. B.

6. The Morus Expansa or Roman Mulberry, is another plant which has been introduced among us, producing a large leaf, and of a hardy character. I have not known the leaf used in any instance for feeding worms, unless the case of Miss Rapp, before referred to, is one; and though I have seen a good many trees of this kind, yet they have all been subject to a decay or sort of gangrene in the bark, which, unless a permanent remedy can be discovered, will effectually discourage their cultivation.

It does not comport with my particular objects to treat at large of the various kinds of mulberry known; but only of those grown among ourselves, and upon whose culture and use for the feeding of worms experiments have been made.

7. The Canton Mulberry is that which I next speak of. This is an admirable plant. The history of the introduction of this tree into the country I am enabled to give in the most authentic form. D. Stebbins, of Northampton, the intelligent and active secretary of the Hampshire, Hampden and Franklin Agricultural Society, and ready to lend his service to any and every good work, desired some of the American missionaries to China, to procure some seed of the best tree cultivated in that empire for the feeding of worms. They transmitted parcels of this seed at two or three different times, from which this tree has been grown. In another case, John P. Cushing, of Watertown, a long time resident in Canton, ordered a shipment to be made to him from Canton of two thousand of the best tree for feeding worms, known in that country. Of this importation, five hundred only survived the voyage. These have been carefully nourished; and with a liberality and public spirit, which has distinguished all Mr. Cushing's efforts to advance the cause of an improved agriculture, he has distributed these plants among his friends and others, and the tree has become extensively diffused.—This tree produces a large, heavy, and beautiful leaf. I measured one among many equally large upon the same tree, which was thirteen inches in length by twelve and a half in width. Perhaps, in general, they are not so large as the Perottet mulberry, but they are in this respect little inferior; and, in proportion to their size, they are considerably heavier. An acre of the Canton mulberry would undoubtedly produce a greater weight of foliage than of the Perottet. They are a tender tree but more hardy than the Perottet; and they may be propagated with about the same facility. There is little doubt that this tree may be acclimated among us; and it will then prove the most valuable tree, as yet known in the State, for the culture of silk.

Dr. Stebbins, who has entered largely into the cultivation of this tree, passes very high encomiums upon its merits. He writes me, under date of 9th November last, "I have preserved the foliage of the large leaf Canton in preference to the Perottet, having thought that leaf best adapted to the feed of worms, for by experiments of the present year, the result has been as five to eight in favor of the Canton feed." This result was obtained by weighing in accurate scales the cocoons made from each kind of leaf. He adds, that "of the cocoons obtained by feeding upon the Canton exclusively, and the white mulberry exclusively, those from the Canton leaf were one-third heavier than the other." Another person from Ohio writes to him, "that the produce of

the Canton by the acre is twice as much as that of the Multicaulis."

These are strong encomiums; but I believe not undeserved, from what in regard to the cultivation of the tree has come under my own observation. I might add other testimonies in favor of the Canton; among others that of Edwin Newbury, a very exact observer and cultivator of Brooklyn, Conn.—and that of Timothy Smith, of Amherst, Mass., both of whom, from repeatcd experiments, give their decided preference to the Canton mulberry over all others.

Many persons are inclined to believe that the Canton is not more hardy than the Perottet; Mr. Smith's experience leads to a different conclusion. I have also the pleasure to add here the actual experience of D. Haggerston, of Watertown, the farm manager of J. P. Cushing; and on whose knowledge and skill in the management of these plants, as much reliance can be placed as on those of any man in the country. His testimony likewise must be regarded as entirely disinterested.

He states, that with him the Perottet mulberry has been killed three winters out of five, root and branch; and two winters to the ground. The Canton trees on the same lot, with the same exposure, have stood the winter, having been killed not below a foot from the ground. He adds, likewise, that of some Canton, which were taken up the last fall, and the roots only covered, in other respects exposed to the weather, are all now (March, 1840,) wholly uninjured. The Canton trees, which were not covered, have come out better than those which had some covering thrown over them, besides having their roots buried. Of the trees referred to in the first case, two hundred of the Canton were left exposed, and about twelve of the Perottet. Some of the Canton referred to were from seed imported from Canton; the remainder were part of the original importation of trees, of which I have before spoken. Upon weighing twenty leaves of the Canton and twenty of the Perottet, taken as nearly alike as possible, the difference in favor of the Canton was nearly an ounce. The Canton is as easily propagated as the Perottet; and, as a plant, nothing can be more beautiful. The leaf is large, lustrous, heart-shaped, and serrated; it is not pendant like the Perottet, and is not so thickly set on the tree as the Broussa.

In this discussion, however, having no private interests or partialities, I have nothing to keep back; and I must add, therefore, that there are some cultivators who still deem it as tender as the Perottet. This may be accounted for, perhaps, in its particular location, if it be placed in a humid and rich soil, and in a situation liable to early frosts. The climate from which it comes is far north of that from which the Perottet is derived. Though from my own observation, and the numerous testimonies given me in the case, I cannot doubt its superior hardiness to the Perottet; yet it is not as yet to be regarded as acclimated; and it would be rash to expose any large plantation of the trees to the rigors of winter, until the habits of the plant are better understood.

The singular fact stated by Mr. Haggerston, that those Canton trees, whose tops were left uncovered, suffered more than those whose roots and branches were both covered, is in a degree confirmed by a statement of Mr. Stebbins.—"The last winter," he says, "I left out about half an acre of Canton roots, of some of which I covered the stumps with turf, grass under; others, with yard manure; others, with earth; others, with a little grass, hay, or leaves; and others had no covering; and these last were the best preserved; and the next, those with the slighest covering; and those with the deepest covering were most injured: and some entirely destroyed by heat.

The extraordinary and luxuriant growth of which these trees are susceptible under favorable circumstances, is illustrated by a fact communicated from the missionaries at the Sandwich Islands in the Pacific ocean. "To show how fast trees grow here," the writer of the letter, to whom some Canton seed had been sent from this country, says, "a tree came up in my garden on the 9th of April. At the end of four months, measuring all the branches, it had grown 87 feet and had 533 leaves. At the end of six months, it had grown 153 feet, and had 939 leaves. It has now (9th January) been growing 9 months and 21 days; and has grown 461 feet, and is now growing at the rate of two feet per day, which at the same rate would give 601 feet of wood to the year; has two main stalks from the ground; one is 5¾ inches in circumference; and the other 5¼ inches.

In attempts to produce mulberry trees from seed, severe disappointments have been often experienced. New varieties are often produced; but inferior plants likewise often show themselves. G. B. Perry, of Bradford, in an excellent essay on the culture of the mulberry, given in the Essex Agricultural Transactions for 1839–40, expresses an opinion that this may often arise from sowing improper seed, or the seed of inferior plants; and in a German treatise on the silk culture, which I have recently received, a caution is given not to sow seed from plants whose leaves have been stripped for feeding the year. These are reasonable and valuable suggestions.

As far, then, as the trees are concerned, the farmers of Massachusetts have within their reach the best varieties yet known. These may be propagated with perfect ease and to an indefinite extent. It would be desirable even to increase these varieties; and for every farmer engaged in the culture of silk to cultivate some of the earlier kinds as well as the later, that he may begin the feeding of worms early, or that in case his eggs should prematurely be hatched, he may have a supply of food at hand before it can be expected to be obtained from the tender varieties. This is recommended by the experience of Miss Rapp, already referred to, as well as of many others.

Private interests have been and are still so much mixed up with the subject of mulberry trees, that great differences of opinion may be expected to exist. Without having the interest of one cent in any mulberry speculation whatever, I have endeavored to give the most authentic information on the subject; and in cases where what I have stated has not been verified by my own personal observation, I have relied upon persons in whose credibility I know that I can place confidence.

CHAPTER V.

*Policy of the Country—Morus Multicaulis Speculation—Its effects on the Silk Business in the United States—General Remarks on the Silk Culture.**

"For more than 100 years it has been well known, that silk of an excellent quality could be grown in this country. It was introduced into the early settlements of Virginia, Georgia and South-Carolina. It was also grown in Pennsylvania prior to the Revolution; Dr. Franklin and other far-seeing men took an active interest in establishing the business. President Styles of Yale College, before and after the Revolution, labored assiduously to establish the business in New-England, and the old town of Mansfield, Connecticut, and a few others in that vicinity became interested, and have been successfully engaged in it for sixty or seventy years.† But the *spirit of the country* and the general state of things, in those early times, were unpropitious, and forbade a wide extension of the business. The great difficulty was the want of a regular market for cocoons and raw silk, and that market was not created, because the spirit of the country was adverse to manufacturing establishments of every kind. The received doctrine of the country down to 1816, taught us by mother England, was that we were to be an agricultural and a commercial, but not a manufacturing people.

"But the Tariff of 1816, settled the policy of the country in favor of domestic manufactures. The cotton business was the first to feel the beneficial effects of the change. The woolen business in like manner, under subsequent modifications of the Tariff, became established. A *manufacturing spirit* as the spirit of the age, was thus generated. This brought up again the whole question in regard to silk, as a permanent business of the country.

"As early as 1826 the Congress of the United States began to call public attention to the culture of Silk; and between that date and 1838, several documents of great value were issued by that body, designed to diffuse information and awaken a general interest in behalf of this business. Some of our State Legislatures also acted in reference to the same end; and in addition to this, about one half of the States enacted laws granting bounties upon cocoons and reeled silk.—Silk Journals were, in due time, established; and the newspaper press throughout the country generally exerted a friendly influence in behalf of this new and promising form of home industry. Much general information was thus diffused, the public mind was arrested, and a very desirable measure of confidence inspired.

"As a matter of course, there sprang up a growing demand for mulberry trees. As was natural, this demand was supplied by our nurserymen, and by those who had actually engaged in growing silk, and in connection with that business. At first there was little or no buying to sell—little or no speculation. For ten years, certainly, there was no general excitement on the subject. The trade in trees, therefore, was perfectly healthy; and continued so up to the fall of 1838. At this time a new state of things began to be developed. That spirit of speculation with which the country was filled, and which had expended its fury upon Eastern lands and Western lands, and village lots, and fancy stocks, and about every thing else bearing the name of property, fastened its deadly fangs upon the mulberry trade. Trees at once took a sudden advance to 40, 50, and 75 cents. The whole community, throughout our widely extended territory, seemed to be moved, and all men ready to embark in the Silk business. In the expectation, therefore, of quick sales in the Spring, trees were extensively propagated in the Winter, in green houses, and upon the tropical islands. Orders were also sent to France for large shipments, all which were ready for the Spring business. Still the supply did not equal the demand, and prices advanced to $1 and $1 25, and, and in many cases yet higher. Men of small means, and large means, and no means, were all eager to go into the *Silk business*. And there were small investments and large investments; all sums from $20 up to as many thousands. Every body must needs have a hand in the *Silk business*. But, mark one thing. Not one in ten *thought* any thing, *cared* any thing, *knew* any thing, or ever wished to know any thing, in regard to the appropriate use of the mulberry—making silk. True, indeed, to put on appearances, they might, or might not, feed a few worms. But it was the *tree* business on which their eyes were fixed—the *tree* business that filled their every thought, sleeping and waking; and limited the utmost purpose of their mind. And this it was that laid the foundation for their own disappointment and the utter prostration of the trade. With an exclusive regard to the large profits expected from trees, they could not of course stop to study the general subject, and in many cases they were intellectually incapable of understanding the large, comprehensive views, on which the business, as a business of the country, rests. Hence, as a body, they had no *intelligent, well-based* confidence in the merits of the business—"no root in themselves"—nothing by which to bear up against any pressure of outward difficulties—difficulties that were even then gathering and thickening upon them, albeit they knew it not. I state this point here, and thus distinctly, because the final catastrophe cannot otherwise be understood.

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* 1. R. Barbour's letter to Dr. H. Jewett, of Dayton, Ohio.

† I find in the Manuscript Silk Journal kept by Dr. Styles, from 1763 to 1791, which with other manuscripts he left to the Library of Yale College, a great many interesting facts, as well as a regular record of his own labors in growing silk, from 1763 to 1773. I give the following entries:

1763, July 28.—Cocoons received at the Public Filature in Savannah, Georgia:

A.D. 1757	1,052 lbs.
" 1758	7,040 lbs.
" 1759	10,000 lbs.
" 1762	15,000 lbs.

1764, July 3.—Capt. Darden tells me, that a gentleman in Georgia raised this year 500 lbs. cocoons, which he sold at the filature for 1*s.* 6*d.* sterling per pound.

1765, August 3.—Rev. Mr. Gilbert, who arrived in Charleston, S. C., in April last year, with the French Protestants, that have formed the settlement of New Bordeaux, in Hillsborough Township, has succeeded so well in the silk culture, that he raised *six hundred and twenty pounds* of cocoons this year, upon the plantation of Gabriel Manigold, Esq., called the *Silk Hope*.

1771, July 3.—The Philadelphia paper says: "We learn that above 800 lbs. of cocoons, most of them of excellent quality, have been already brought to the Public Filature in this city; the silk produced from them being of extraordinary beauty"

"In April and May the trees were planted, and as early as July contracts began to be made for the growing trees, and continued to be made through the Summer at prices ranging from 15 to 37½ cents. These were about the prices which had been anticipated.

"To show the disastrous bearings of the monetary affairs of the country, in a special degree, on this business, it is necessary here to say that these contracts were to be consummated when the trees were done growing—in October. So also, in many cases, in the Winter and Spring, trees were bought to plant on credit, or funds hired to pay for them, depending on the Fall sales to meet the engagements. Thus about all contracts connected with this whole business—contracts involving millions of dollars, and extended all over the Atlantic and many of the Western States, were thrown into that month. In the meantime the financial affairs of the country, as you and all business men well recollect, were growing worse and worse all that Summer. The banks were shortening their discounts from month to month, until the 9th of October, when the United States Bank failed for the second time. Upon this all the local banks stopped discounts, and those South and West of New-York generally stopped specie payments. This most disastrous turn of things threw about all our business men in the land into scenes of sudden and unlooked for embarrassments, and multitudes were at once involved in hopeless bankruptcy.—And that *month, the month of October*, 1839, is burnt indelibly upon the recollections of thousands of excellent men in all the departments of business, who will never read this incidental reference to their past sufferings.

"But these mulberry contracts, large and small, throughout the country, as before stated, all came along in that ill-fated month. And what was the necessary consequence? Why, it was a general and a simultaneous failure among the contractors, especially the large operators, who depended more directly upon bank facilities to meet their engagements. What was the next result? An immense amount of trees were thrown back upon the growers, or in some form pushed into the market to be got off at forced sales. This of course caused a sudden and a great depreciation of prices.

"Yet this was only the *beginning* of the trouble. There was at this time, interest enough, and confidence enough in the Silk business, in the community, to have sustained this shock, severe as it was, if there had been nothing more, or nothing worse. But in this critical juncture of affairs, a juncture demanding the utmost coolness, and firmness on the part of all interested, a *universal and uncontrolled* panic seized the great body of the smaller dealers—The men who had invested from $50 to $500, and who constituted the great numerical majority, perhaps nineteen-twentieths of the whole number interested in trees. As if by some unseen, uncontrollable power, these men were every where seized with a fixed determination to get rid of their trees at any price, and on any terms. Talk with them? As well talk with the whistling wind. Explain to them the financial causes that had been at work to produce this temporary depression on this, and on all business? As a class, they were too ignorant of general business to understand any of these questions. Unfold to them the essential merits of the Silk business, the great principles on which it is based, as a permanent business of the country? It was too late in the day to teach them this neglected lesson. *Selling trees, selling trees*—this was the only thing their eyes had been fixed upon, and now that trees had fallen 25 to 50 per cent in a few weeks, they were determined to be rid of them at all events. No instruction, no remonstrance, no intreaty was of any avail. Fear had taken full, and uncontrolled possession of the mind; and every day's rumor only extended and augmented the panic. Hence they at once began to run upon each other. If A. offered his trees at 20 cents, before night B. offered his at 18, and the next day C. had as good trees as ever grew at 16, and would even take less, rather than lose a sale, as he wanted money. So the alarm spread like wild fire. They run from one to another trying to *gouge* each other, and from neighbor to neighbor, betraying the utmost anxiety, and resorting to all manner of devices to effect sales. Wagons loaded with trees were driving, Jehu-like, from town to town, and in every direction, each load of course cheaper and better than any that had gone before, or would come after.

"In this way it did not take long to run the prices down to 5 or 6 cents. From 2 to 5 weeks did the job most effectually. Here the whole trade was brought to a dead stand. At 5 cents some small sales were perhaps made, but below this, nothing could be done. All the interest of the community in the business had been completely used up, and all confidence destroyed. No body would touch a mulberry tree at any price. An entire revulsion had indeed come over the public mind in regard to the whole matter. The great body of the people understood not, even our more intelligent business men uninterested in the matter, understood not, the *special* causes, as here stated, that had combined to bring this business into such a forbidding and ominous shape; but now that they are stated you will at once see the whole matter. The truth was the owners of trees proclaimed, by their conduct that they themselves had no confidence at all in the intrinsic value of their trees, and it was perfectly natural, therefore, that every body should believe them, and finally refuse to take them at any price: so that they now have this cool comfort, that they, themselves, by their own folly, ruined the trade, and brought down upon their own heads the very evils they were struggling to avert. Beyond all question, all the trees in the country would have been put in requisition for making Silk, at 10 to 12 cents if none had been offered for less.

"It was at the South where this strange work began. It was there where the crash in our moneyed institutions began—there where the failures among the large dealers in trees began, and there where the subsequent panic among the smaller ones began. But the causes spread as rapidly as steam and horse power could spread them; and the same disastrous results every where followed in quick time: so that by the last of November the work was all done up throughout the

country, and every thing settled down to a dead calm. Nothing was heard, save the muttered curses of the disappointed speculators, and the self congratulations of the wise ones, who, from the commencement of the silk business, had been foretelling ruin, and only ruin, to all concerned in it. This class of men must needs, of course, take every occasion to let it be known that they never had any faith in this new business; that they always knew it was all moonshine; that silk cannot be made in this country; only they did n't think the bubble would burst quite so soon.

"Thus things remained through the coming winter, yet the hope was cherished, that sales would revive in the spring: and, in anticipation of this, the auction cellars in New-York, Philadelphia, Baltimore and other centres of the business were filled with trees, and hundreds of thousands were buried in sand banks in the country, waiting the anxious event. But the spring came, bringing along with it other desirable things, but no demand for mulberry trees. The money affairs of the country remained yet unimproved, and of course there were no central movements in this business. But more than all, the public sympathies on this subject had been completely exhausted, by the course pursued the preceding autumn, and the great body of the people seemed to have settled down quite at ease in the conclusion, that the Silk business had been tried, and found wanting; and that nothing more would ever be heard about it, except in the history of by-gone delusions. And the owners of trees themselves, in unnumbered instances, as if in the pitiful vexation of disappointed hopes, or as the means of regaining the good opinion of their neighbors, joined in the shouts of popular triumph over the prostrated folly; and, to bring forth fruits meet for repentance, doomed their hated trees to the flames and the floods. The extent to which the destruction of trees was carried in 1840 is almost incredible. The auction cellars, before alluded to, were emptied into the streets, and thence transferred to the docks. Hundreds of thousands buried in sand banks in the fall of 1839, remain undisturbed to this day,* and acres upon acres that were left standing in the field were ploughed up, and burnt by the road side. A friend in New-Jersey wrote me, that at least nine-tenths of all the trees in the neighborhood of Philadelphia were thus wantonly destroyed. The same, I apprehend, is essentially true in regard to all the other great *centres* of the speculation. And according to the best estimates that can now be made, it is presumed, that at least three-fourths of all the trees with which the country had been supplied, by importation, and by propagation, in the space of some 12 years, and at an expense of many hundreds of thousands of dollars, have been in this wanton and inconsiderate manner, under the exasperations of disappointed hopes, and blasted expectations, consigned to destruction.

"In some cases this destruction of trees was unavoidable. One owner perhaps had become hopelessly involved in his affairs, and could not go on with the business. Another had more than he could possibly use for making silk, and of course the remainder must perish. But in a great majority of cases the destruction arose from motives as above alleged.

"I am aware that there are other causes supposed to have had a special agency in bringing on the revulsion of public feeling here described. It has been often alledged, that there were extended combinations among the principal dealers in trees, to run up prices: and extended combinations among those who wished to purchase, to run down prices. Of the truth of these charges, I have never seen any conclusive evidence on either side. And yet they may be all true. We know there is depravity in man, in unstinted measures, and whenever money is concerned, we expect to see its developements. Do we not see combinations, and all manner of contrivances, and arts, and deceptions in other departments of trade? And yet all this wickedness, discovered or suspected, does not lead to such results as here described in regard to the mulberry trade.

"It is perfectly evident, therefore, the grand, the all controlling cause, that led to this sudden and universal prostration of the tree business, was what I have here stated. Pray tell me, how could it be otherwise? We always take it for granted, that men interested in any description of property, will over estimate, rather than under estimate its value. Another thing we always take for granted, and that is, when the owners, generally, of any species of property, are all anxious to sell, and are daily falling in their prices, that there is trouble in their business somewhere; and a wise man, in all such cases, especially if he is himself unacquainted with the business, will keep clear of it until the waters become settled.

"And this is the case in regard to the matter in hand precisely. The owners of trees, in the fall of 1839, in their uncontrolled and undisguised eagerness to sell, practically declared, that they had no confidence in their value for any purpose, and of course others would have none. Then to put in and destroy them as they did, was only to confirm the opinion, on the part of all uninterested spectators, that mulberry trees are intrinsically worthless. To any one not understanding the causes that had been at work to bring out these results, such an inference would be the only obvious and natural one suggested.

"But I think I have presented the case in its true light. Unless I entirely misjudge, you will see, and every body else will see, that the *Multicaulis Speculation* as it was called by way of distinction, and as it will always be called, in its origin, progress, and disastrous termination, had the least possible connection, with the *Silk Business*, and shows nothing, in any way, in regard to the merits, or demerits of that business. The connection between the two things was about the same as between the Eastern land speculation, and shaving shingles. Stripped naked, this speculation was a mere trade in trees, and the only thing which it conclusively demonstrates is, that *popular phrenzy* furnishes but an unsafe guide in matters of business, the same as in religion, politics, and every thing else.

* In the spring of 1841, a friend in W. Conn. bid the writer welcome to a lot of large leaf Cantons that had been buried two winters and one summer. I sent my team, dug them out, and brought them home, and planted them. They did as well as the average of trees.

Remarks.—(1) This revulsion in the tree business prostrated the most of our Silk Companies, and Silk Factories then in existence. They were generally projected on a large scale, and involved large expectations, altogether too large for experimental operations, and were generally conducted without much regard to economy. They had not gone far enough to derive much profits from growing, or manufacturing Silk. Their main dependence was upon the sale of trees, and when this source of income was thus suddenly cut off, they were of course prostrated.

(2) It is a remarkable fact, that out of the thousands, who, without any previous study, or practical knowledge, of the Silk business, purchased trees under the excitements of the speculation, very few, if any, are known to have persevered, and to be now engaged in growing Silk. My own personal acquaintance with Silk growers is somewhat extensive, and I do not know a case of the kind. I do not assert that there is none, but this I do say unhesitatingly, that the men now engaged in this great business—great I mean, in its beneficent, wide spreading, and far reaching results, are made up, as a body, of those who engaged in it prior to September, 1838, and those who have gone into it since Jan., 1840. As to the rest, the *thousands*, the *great numerical majority* that came in between those dates, flushed with zeal, and faith, and patriotism, and all that sort of thing, what has become of them? Gone, gone off in smoke, all melted away, only leaving a terrible grease spot behind.

(3) The Silk business in this country now stands upon a broader, and a firmer basis than ever. In confirmation of this statement I would refer to the following points.

(*a*) It has outlived the disastrous revulsion here sketched. This surely bespeaks something for its essential merits. By actual results in making silk brought out in different parts of the country, the entire feasibility of the silk enterprise has been demonstrated to the satisfaction of intelligent men, who have paid due attention to the subject. Those who engaged in it prior to the speculation, and of course without any expectation of large profits in trees, and those who have gone into it since the speculation exploded, have generally gone steadily forward, with a confidence increasing with the increase of practical knowledge.

(*b*) We have fully established the high character of several varieties of the foreign mulberry tree. Their relative claims is indeed a question not so definitely settled. But that the Multicaulis, Cantons, Asiatics, and Alpines afford more foliage, in far less time, and with far less labor, than the white Italian; and are, when rightly managed, every way safe from the perils of winter, no intelligent man, acquainted with the business, even affects to doubt. So also it has been demonstrated, that under our brilliant skies, and bracing winds, and upon our fruitful hills, and exhaustless prairies, these trees grow with unsurpassed luxuriance.

(*c*) Our Silk, *in the state in which the worm leaves it*, is found to be a decidedly superior article.* On this point we have the concurrent testimony of American and European manufacturers, some of which you may see embodied in the First Report of the New-England Silk Convention. I refer to this fact in this connection as establising another fact, viz. the peculiar adaptedness of our climate and soils for the Silk Culture, in as much as these are the permanent causes that control the quality of all the productions of the earth. In open culture, as every body knows, you cannot get a first rate product, whether of grain, grass, fruit, or vegetable, only where the climate and soil are congenial. The fact therefore, that American raw Silk, *when properly reeled*, is a decidedly superior article and commands a higher price in the market than any we can get from Europe, is full demonstration of the position in support of which it is adduced: and, with unerring precision, points to the day when unborn millions, in this land, will be clothed and fed, and edueated from this delightful form of rural industry.

(*d*) It is evident, also, that in the few years we have been engaged in the business, we have supplanted the European system of feeding, as first presented to the American community. Enclosed buildings, with furnaces, and ventilators, and thermometers, may, or may not, be needful there; but in our climate, variable as it is represented to be, the fact is well established, that in the way of building, all we need is the open shed, or tent, securing ample shade and heaven's pure air essentially unobstructed.

(*e*) All our agricultural papers are now friendly to the Silk culture, and most of them zealously engaged in promoting it. The political press, also, in many cases, is exerting a good influence, and in none, a prejudicial influence. The laugh, the jibe, the sneer, are all done with. Every joke has been cracked, and not a word from any paper in the land have I seen for two years, otherwise than friendly in its design and tendency.

(*f*) The new Tariff, although needing modifications, was designed to place this business, so far as legislative protection is concerned, upon a level with other great national interests, and therefore operates to give it a passport to the confidence of business men.*

* In President Styles Journal, before quoted from, I find this entry.

1763, July 7.—Dr. Franklin, of Philadelphia, told me today, that the Italian raw silk sells for 20*s.* sterling per pound, in London, and the Georgia silk for 25*s.* sterling per pound.—I suppose 12 oz. Troy; and that a mulberry tree in Italy is estimated worth 20*s.* sterling, a year. (An Italian White, in a bearing state, is the tree here referred to. I. R. B.)

* Sec. 3. *And be it further enacted*, That from and after the day and year aforesaid, there shall be levied, collected and paid, on the importation of the articles hereinafter mentioned, the following duties, that is to say:

First. On all manufactures of silk not otherwise specified, except bolting cloths, two dollars and fifty cents per pound of 16 ounces; on silk bolting cloths, twenty per centum ad valorem: *Provided*, That if any silk manufactures shall be mixed with gold or silver, or other metal, it shall pay a duty of thirty per centum ad valorem.

Second. On sewing silk, silk twist, or twist composed of silk and mohair, a duty of two dollars per pound of 16 ounces; on Pongees, or plain white silks for printing or coloring, one dollar and fifty cents per pound of 16 ounces; on floss and other similar silks, purified from the gum, dyed and prepared for manufacture, a duty of twenty-five per centum ad valorem; on raw silk, comprehending all silks in the gum, whether in hanks, reeled or otherwise, a duty of fifty cents per pound of 16 ounces; on silk umbrellas, parasols, and sun shades, thirty per centum ad valorem; on silk or satin shoes and slippers for women or men, thirty cents per pair; silk or satin laced boots or bootees for women or

(*g*) Our manufacturers, in some cases, are now shaping their business in reference to taking up Silk. Silk factories are springing up here and there over the country, and will be multiplied as the times shall seem to justify. All this tends to give the whole business the aspect of a regular settled business, and by creating local markets for cocoons, and raw silk will rapidly extend the growing of silk.

(*h*) The amount of Silk made in years past has been constantly increasing, each year just about doubling upon the preceding year. In the States where legislative bounties are given we have the means of showing this increase, with great precision. In Ohio, the amount of bounty paid in 1839, was $71 10; in 1841 it was $2,631 76. In Pennsylvania the amount paid in 1840, was $2,101 39; in 1841 it was $4,413 35. In New York in 1840, 2,100 lbs. of cocoons were raised; in 1841, the amount had arisen to 6,426 lbs.

I called upon our State Treasurer, in Boston, last October, and he kindly gave me the following statement, showing how this matter stands in Massachusetts:

In 1836, the first year of the law, he paid	$71.37
1837	198.00
1838	350.52
1839	434.62
1840	1233.59
1841	2111.42
1842 to Oct. 1	3351.91

(*i*) All further destruction of trees has been arrested, and the past season we have had some small sales of trees at small prices, indicating a favorable change as coming over the minds of men on the subject.

(*j*) Our agriculturists now feel, and acknowledge their need of a new staple. Cotton, Tobacco, Wheat, and all our other staples are at present depressed, and no signs of essential improvement. The markets of the world are glutted. In this crisis, Silk is beginning to arrest attention, and the hopes of many are fixed upon it, as furnishing a staple of unlimited extent, and one with which the market cannot be glutted for 50 years.

These remarks present to thinking minds the Silk business as full of hope and encouragement to those interested, and to our country. In spite of all the multiplied discouragements which have beset its progress, it has made its way along—has worked out for itself a name, and that name commands the respect and the confidence of our intelligent business men in other and different employments. The great question is indeed I think settled, that our country is to be a Silk growing, and a Silk manufacturing country; and if we do not, in due time, take the control of the markets of the world for Silk goods, it will not be in keeping with American skill, and American enterprise; nor coming up to the limits of our ability.

men, seventy-five cents a pair; silk or satin shoes and slippers for children, fifteen cents per pair; silk or satin laced boots or bootees for children, twenty-five cents a pair; on men's silk hats, one dollar each; silk or satin hats or bonnets for women, two dollars each; on silk shirts and drawers, whether made up wholly or in part, forty per centum ad valorem; silk caps for women, and turbans, ornaments for head-dress, aprons, collars, caps, cuffs, braids, curls, or frizettes, chemisetts, mantillas, pelerines, and all other articles of silk made up by hand, in whole or in part, and not otherwise provided for, a duty of thirty per centum ad valorem.

(4) We must now go to work, and re-supply the mulberry trees that have been wantonly and inconsiderately destroyed, as shown in this letter. And there is not only this amount to be grown, but many millions more. The state of things is now vastly different from what it was in the fall of 1839. At that time nineteen-twentieths of all the trees in the country had got into the hands of mere speculators, men that knew nothing, and cared nothing about the Silk business, only as affecting the price of trees then in their hands. But at this time, all the trees saved from the general destruction are in the hands of Silk growers, and about equally diffused over the country and in actual and profitable use, and can be multiplied at reasonable prices. We have preserved, cultivated, and to some extent multiplied them, knowing their value, and knowing too, that their value would, in due time, be appreciated for the purposes for which they were designed. Popular frenzy, we know, on any subject, will in time consume itself, in its own fires. Mere prejudice cannot reign for ever. And I rejoice in the manifest indications of a returning public confidence already visible. The change, in this respect is truly encouraging, as those of us well know, who have the means of knowing any thing respecting the matter. If nothing occurs to turn back the tide of public feeling now setting in our favor, in a short time all the trees in the country will be in demand at *fair business* prices, the same as any other property, and *many millions* not yet grown. Beyond all doubt, therefore, it is for our interest, and the regular progressive advancement of the Silk business, that we should take all appropriate care of our trees, and multiply them as much as be convenient. I would earnestly press this matter upon the attention of my Silk friends. Multiply your trees. Use every care, consult every expedient, tax the best energies of your minds to curtail expenses, and simplify and improve all the various processes of making Silk—*feeding, cleaning, ventilating, and reeling;* and at the same time *multiply your trees.*

(5) The nature of the business forbids as rapid an increase, in the amount of our silk crop, from year to year, as in most other agricultural crops. Your silk crop must be limited by the amount of your foliage, and this by the number and age of your trees, and the fertility of the soil on which they stand. The silk culture, therefore, resembles the fruit culture more than any other agricultural pursuit. In both it takes a proper time to bring out the results aimed at. With the White Italian Mulberry, which is propagated from the seed, we cannot get foliage to much amount short of three or four years. With the foreign varieties, Multicaulis, Cantons and Asiatics, we can usually do something the first season. In the summer of 1838, Mr. J Danforth, of East Hartford, Conn., put out one-eighth of an acre with Multicaulis, as an experiment; and made nine pounds prime silk which he exhibit at the Fair of the American Institute, and took a liberal premium. This was at the rate of seventy-two pounds to the acre. The Rev. Mr. McLean, of Freehold, N. J., stocked one-quarter of an acre the next season, for the same purpose; and brought out a little less than fifty pounds to the acre. But

I do not present these as results to be ordinarily expected. The land in both cases, was rich, and more trees were put out than is by any means best for permanent profit. The early part of the season was peculiarly favorable for the growth of the trees, and the latter part for feeding—two things on which the whole matter very much turned. We cannot ordinarily expect such a season throughout. We have had none since equal to it. As a general rule, therefore, we cannot place much reliance upon feeding from trees the first year of planting them. Yet we can generally do something. If the season is early, and the weather warm and dry, with occasional showers, from the middle of July through August, we can do a good business.

(6) Moneyed men have now every reasonable inducement to invest their funds in this new form of home industry—growing and manufacturing Silk. For nearly four years the financial state of the country has been such as to paralyze all enterprise, and forbid all onward movements, especially in new and untried forms of labor. In this time, however, in regard to the Silk business, elementary questions have been extensively tried, and satisfactorily settled, though generally in a small way, because the means of those concerned in these operations are small. And we have yet much to learn. At the same time a vast amount of practical knowledge has already been gained, and gained too, in many cases, as may well be supposed, at a dear rate. All this knowledge is now available for larger, and more productive operations. The way is indeed prepared for onward movements on any scale that suits the pecuniary means of those concerned—large or small, in growing, or in manufacturing. But it is our enterprising business men who must move in this matter. To them we look. Money is now abundant in our cities, and gradually getting into circulation in the country, and general business is slowly recovering from the extreme depression under which it has been so long laboring. With all confidence, therefore, we invite the candid and earnest attention of these men to this great subject. True, the business has had many and great difficulties to contend against. I am not ignorant of the fact, that many large manufacturing establishments have been utterly prostrated, nor of the causes that led to these disastrous results, as before stated. On the other hand, it is with great pleasure, that I can refer to the Rapps and Gills, and Storrs, and Atwoods, and Conants, and Swifts, and Dales, and Murrays, and many others, who have successfully surmounted whatever difficulties have beset their path, and are now reaping the rich reward of a well directed, a cautious, and a persevering industry. Nor am I ignorant, that some large feeding establishments have failed to secure satisfactory results, and that some have been given up. But it is equally certain that *transient* rather than *permanent* causes have operated to defeat expectations in such cases, so far as these expectations were any where within the limits of reason, as many were not. In some cases the eggs hatched were from a diseased stock. In more, disappointment resulted from an insufficient, an irregular supply of food. Still more, from *inadequate ventilation*. To this latter cause beyond doubt, a very large proportion of the disasters referred to, especially in large establishments, are to be traced. At any rate from facts recently published by J. W. Gill, Esq. Mount Pleasant, Jefferson Co., Ohio, Dr. Stebbins of Northampton, and myself, and some others, it is quite evident that Silk Worms may be fed with entire safety, in opensheds and tents, with a great reduction of expenses, and a great increase in the value of the crop, as compared with any of the old modes of feeding in enclosed buildings.

It is proper, however, here to say, that our feeding, whether open or close, should be as early in the season as it is possible to secure foliage. I would say further, that in open feeding, the silk culture may be extended indefinitely, and as rapidly as trees can be multiplied. The culturist may have his tents, or feeding sheds, few or many, located in different fields on his lands, wherever the soil is most friendly to the growth of the trees.

With full confidence, therefore, we ask our business men to examine the merits of the Silk question. We want their aid and coöperation. Our means are limited. Those especially engaged in growing, are generally doing it in a small way, because we cannot do as we would. As a class, if we have a fair measure of any thing, it is faith and perseverance, amid general incredulity, and opposition and ridicule, and almost every thing else that can turn mortal man from his purpose. But we have held on,—have seen the worst of the case, and now rejoice in the manifold indications of a growing public favor; and in the well assured expectation of a remunerating business, for ourselves, our children, and our country.

CHAPTER VI.

Amount of Silk to an Acre—Cost of Production—Numerous Authorities.

Questions of great importance come up here, respecting the amount of silk which may be produced upon an acre of ground, and the cost of production at the rates of labor existing among us.† On these subjects conjectures abound; and calculations respecting the amount to be obtained so enormous and extravagant, that they are much better suited to form a chapter in the Arabian Nights' entertainment, than to enter into the thoughts of any sound mind. Conjectures, however, in matters of this kind, are not what we want; and it does not belong to me to present them to the farmers of Massachusetts. I have to lament, however, that few exact experiments in this case have been made in the country; and that many points, the decision of which, in my opinion, is more likely to have a favorable than an unfavorable influence upon the silk culture, remain to be determined. In my intercourse with the agricultural community, the mortifying conviction is continually forced upon me, of the very small number of persons, upon whose authority any strong reliance can be placed for that exactness of observation, which constitutes the first element of all true science, and all useful and prac-

† Colman's Report on the Agriculture of Massachusetts.

tical information. It is said that in the map of the world in use among the Chinese, and to which they go to study geography, the empire of China occupies about two thirds of the whole surface. Too many of our farmers in their sketches of their own domains, and their own operations, are too prone to measure things by this Chinese scale. I shall have the pleasure, however, of referring to some authorities entitled to entire respect and confidence, to the extent to which they go.

1. Timothy Smith, of Amherst, who has had considerable experience in the production of silk, says in a letter to me, "I consider that one acre of white mulberry, set in hedge rows, will yield foliage for fifty pounds of silk; and presume to say that an acre of Multicaulis (Perottet) will yield double the quantity to an acre of white. I consider that reeled silk costs me about two dollars per pound, not over; although it was a year of experiments; but feel confident that in two or three years, by using the best kinds of mulberry and the better economy, that silk can be made for one and a half dollar per pound."

In a subsequent letter, Mr. Smith remarks, "I consider the Multicaulis the most tender variety of any that I have cultivated. I consider the Canton as my best mulberry tree for raising silk, taking into consideration the hardihood of the tree, and the quantity of foliage it yields. I like the Italian white; and think it best to cultivate some of each variety."

I understand Mr. Smith here to estimate, in the cost of the silk, the value of the labor only; and to charge nothing for the use of the land and cost and care of the trees; nor any rent for his cocoonery. These items would add something to the cost of the silk, but it is not easy to calculate them, from the imperfect elements which are given. It will be seen in this case, that although Mr. Smith has had some experience in the production of silk, yet that his statements are somewhat conjectural. In his supposition, likewise, that he could obtain one hundred pounds of silk from an acre, planted with the Perottet mulberry, and that he hoped to reduce the cost of the production of reeled silk to one dollar and a half per lb., a little allowance is perhaps to be made for the quickness of pulse, which in that time of excitement was felt by every cultivator of mulberry trees in his visions of the profits of the Multicaulis.

2. The next approach to the actual cost of the production, is presented by James Deane, M. D. of Greenfield, Mass. His admirable letter to me on the subject, I shall give in the appendix. He estimates the cost of reeled silk at from two to two dollars and a quarter per pound. He produced the last year several pounds of silk of as fine a description as could be made. When he undertook the culture of silk, he had never seen a silk-worm nor a silk reel. He constructed a reel, admirable for its simplicity and efficiency, of which I shall give an engraving; and his operations from the beginning to the end were crowned with perfect success. This demonstrates the great simplicity and feasibleness of the operation. Dr. Deane is so remarkable for his carefulness, that his statements, where statements are given, may be implicitly relied on. The cost of producing the silk, however, is with him rather a matter of estimate or judgment, than of a careful observation of every minute charge; and, like Mr. Smith's, embraces only the labor applied.

3. The next authority to which I refer, is, that of D. V. McLean, of Freehold, Monmouth County, New-Jersey. No experiment has been given to the country so numerous in its details and instructive in its results, as this. From the time employed and the wages paid for the production of twelve pounds of silk, he comes to the conclusion, that raw silk may be produced and reeled at the rate of two dollars to two dollars and one quarter per pound, though he admits, that "his cost him much more than this." This, likewise, is to be understood as the cost of the labor only applied to the production of the silk from the eggs; and with out any allowance for land, trees, or cost or rent of cocoonery.

4. In Mansfield, Connecticut, it is customary with those who have trees, to furnish the eggs, to board the woman employed in the process, and to allow her half the produce in silk. She performs all the work, from the hatching of the worms to the reeling of the silk. The board of a woman in this case is estimated at one and a half dollars per week. I have no means of ascertaining how many worms a woman would be able to manage.—The general estimate is, that one woman will feed 60,000 worms. It has been stated to me, that in one instance, one woman took the care of 120,000 worms; but I am unable to obtain the particulars of the case; and to learn whether she had any aid in picking the leaves or not. In the commencement of the feeding, the time of one woman would not be occupied entirely by an amount of worms, which at the close of the feeding season would require her whole and exclusive attention. Various circumstances, likewise, must come into the account; such, for example, as the facilities for feeding the worms; whether the leaves are to be gathered from high standard trees or from shrubs; and whether they are to be plucked from the white mulberry or the improved varieties. In the improved cocooneries small cars fixed upon a railroad are used to convey the leaves from one end of the room to the other; and at a great saving of labor and time. The use of hurdles likewise, so as to facilitate the cleaning of the worms, will serve to lessen the labor. Practice and experience, as in all other cases, may be expected to bring with them their usual advantages. Under these circumstances, it is not easy to determine how large a family of these industrious and hungry operatives may be placed under the stewardship of one person. In Mr. Smith's operations, two women were occupied about five weeks in feeding the worms for the production of about twenty pounds of silk; but how long was required for the reeling is not stated. They received three dollars each per week, and board, which must be rated at one dollar and a half each per week. In Mr. McLean's experience, the labor of two women and a man twelve weeks each, would be required to attend upon one acre or 160,000 worms; and he estimates their expenses, including board, at three dollars per week each. These wages might be deemed ample for a woman's labor, but it is not more than half of the cost of a man's labor in Massachusetts. Mr. McLean's cocoonery, which I had the pleasure of visiting, combines many advantages of construction; and his foliage

was gathered from the Perottet mulberry, planted the same spring, and growing luxuriantly directly in the vicinity. His experiment, however, though conducted in a manner creditable to his remarkable intelligence and public spirit cannot be said to determine in a satisfactory manner the cost of production; though I think it fully decides the question at the present prices of raw silk and of sewings, in favor of the profitablencss of the culture, within reasonable limits; and at a fair value of land, labor, and trees. Any very great increase of production must of course be followed by a reduction of price.

5. Calculations made by John Fiteh, of Mansfield, Connecticut, are as follows. I have not the pleasure of a personal knowledge of Mr. Fiteh; but his reputation is a guarantee for the eorrectness of his statement. It is, as will appear, somewhat matter of judgment, but, I presume, founded upon experience.

One aere of full grown trees, set one and a half rod apart, will produce forty pounds of silk.

The labor may be estimated as follows:

For the three first weeks after the worms are hatched, one woman who is acquainted with the business; or children, who would be equal to such a person.

For the next twelve or fourteen days, five hands, or what would be equal to five, if performed by children. In this period, two men with other help would be employed to better advantage, than all women and children. This period finishes the worms.

For picking off the balls, and reeling the silk, it will require about the same amount of labor, for the same length of time, as the last mentioned period, which may all be performed by women and children. The aforesaid labor and board may be estimated at eighty dollars; spinning the silk at thirty-four dollars; forty pounds of silk at the lowest cash price, is now worth two hundred dollars, which makes the following result:

40 lbs. of Silk at $5 per lb	$200
Labor and Board	$80
Spinning	34—114
Net profit per acre	$86

The principal part of the labor may be performed by women and children; but where the business is carried on to a considerable extent, it is considered more profitable to employ some men for the last period of the worms.

This account of Mr. Fitch, it will be seen, makes no allowance for any capital invested in trees, land, or buildings; or for any expenses which the care of the trees, land and buildings may require; and it refers only to the use of the white mulberry as standard trees.

6. The calculation of an intelligent silk-grower at Manchester, Connecticut, and who is a cultivator of the Perottet mulberry, is as follows. He estimates the value of the trees at twenty-five cents each, and he requires three thousand to stock an aere.

COST.

Of trees for an aere	$750 00
Value of land	100 00
Capital invested	$850 00
Interest on $850	51 00
Labor in picking leaves	25 00
Labor feeding worms, & reel'g silk	50 00
Extra manure for land	20 00
Total	$146 00

RETURN.

50 lbs. of Silk at $5 per lb	250 00
Deduct charges	146 00
Total	$104 00

The labor here is undoubtedly underrated. The number of trees upon an acre, 3,000 is also underrated, unless upon the presumption that these trees are counted before they are laid down; if laid down in a furrow they would be multiplied many times. In Mr. McLean's case, there were 5,500 trees upon a quarter of an acre, or, 22,000 upon an acre. The price of silk, is in a considerable degree, capricious. The quantity produced upon an acre is matter of fair calculation. I do not rely with much confidence upon this statement; but I give this example for the sake of showing how difficult it is, even with observing men, to arrive at any certain result.

7. T. W. Shepard, of Northampton, fed worms to an amount not known, but supposed from 75,000 to 100,000. Commenced feeding about the middle of August; and the worms wound in about five weeks. The worms were of the two crop kind. About 2,150 lbs. of leaves were picked from small Alpine and white mulberry trees; all the leaves were stripped off with many of the small branches; and owing to the latcness of the season, many leaves were very rusty. All the labor of picking leaves, tending the worms, and preparing bushes for winding, was performed by one man in five weeks, except paying a boy three dollars for picking leaves; and the first two weeks the man was not engaged more than half the time. The cocoons measured twelve bushels; one bushel was saved for seed; and the remainder reeled by a young girl, totally ignorant of the business, having never reeled an ounce before. The amount of silk reeled was eight pounds. Under the most favorable aspect, the cost in this case, cannot be considered less than three dollars per lb. for labor only.

Joseph Conant, of Mansfield, Conneeticut, trained to the culture of silk from his childhood, and upon whose intelligent and calm judgment, I should place much reliance, says that an acre of land may be expected to produce from thirty to fifty pounds of silk. D. V. McLean obtained at the rate of 48 lbs.; or, allowing for waste and accident, at the rate of 50 lbs. to the acre. He adds, that he should utterly despair of obtaining 104 or 128 lbs. to an acre. Mr. McLean's produet, under the circumstances of the case, may be regarded as a medium produet; but how much more may be obtained it would be idle to state, until some exact experiments have determined this important point. Fifty pounds of silk to an acre then affords the only safe basis on which at present we may make our calculations as to the profit of the business.

There are some other points conneeted with the culture of silk, to which it seems proper to refer. In all cases of this nature, well established facts are what we mainly seek after. When I speak of well established facts it will be understood that I

do not estimate testimony merely by the number of witnesses; for with respect to agricultural matters, as in other matters, a large portion of mankind in what they state only echo the sentiments of others, and they perhaps persons not very competent to teach; and are like parrots, who can utter only what they have heard others say.

It is often stated that one hundred pounds of leaves will feed worms which will make 1 lb. of silk. Aaron Clapp of Hartford, states, that 80 lbs. of the Perottet mulberry leaves will do it, and this is asserted by many others. I do not learn from Mr. Clapp's conversation or his book, that this result has been reached by actual trial. The problem, however, has, perhaps, been more nearly solved by some others, and to their authority we shall defer.

Ralph Storrs, of Mansfield, Connecticut, states that it requires 200 lbs. of the white mulberry leaves for one pound of silk. Joseph Conant of the same place, says, from 100 to 120 lbs. of leaves will make one pound of silk. I cannot reconcile the difference in the testimony of these two gentlemen, both of whom are experienced in the silk culture, but by supposing that they have never made an exact measurement in the case; or that the former in the weight of the leaves included the weight of small branches or twigs, which were collected with the leaves.

I have, however, two testimonies, which rest upon exact measurement. Mr. McLean says, that the whole number of worms fed upon his quarter of an acre was 40,000. The weight of leaves consumed, 2,576 lbs. Amount of cocoons produced, 130 lbs., weighed just as taken from the shelves, without sorting or flossing. After they were sorted and flossed there was 1 lb. of floss and 4 lbs. defective cocoons, leaving 126 lbs of cocoons.—These produced 12 lbs. of merchantable reeled silk, 16 oz. to the lb., and 1 lb. wastage, ends, &c.

From the above statement it will be seen, that it required between 19 and 20 lbs. of leaves to make 1 lb. of cocoons. Of these cocoons, without flossing or sorting, it required 10 lbs. and 10 oz. to make 1 lb. of reeled silk. After they were flossed and sorted, it required 10 lbs. and 5 oz., or about 214 to 215 lbs. of leaves, to make 1 lb. of reeled silk. These were the leaves of the Perottet mulberry. After making various allowances for waste leaves, Mr. McLean thinks it may require 190 lbs. of leaves to make 1 lb. of silk. The first statement is the result of an actual trial; the latter is matter of opinion.

Mr. Shepard, of Northampton, in an experiment made by himself, the last summer, found that it required 240 lbs. leaves and twigs of the Alpine and white mulberry to 1 lb. of silk. He adds, that had all the leaves been free from stem and rust, probably 200 lbs. would have been an ample supply for a pound of silk. These are the statements of a gentleman of perfect credibility, and the result of exact experiment. They are to be disproved only by more full, more exact, and repeated trials.

To his account Mr. McLean adds: "last year I produced at the rate of 510 lbs. of cocoons to the acre; this year I produced at the rate of 520 lbs.; and my deliberate opinion is, that more will fall below this standard than will exceed it; and in one case where the less quantity of leaves will give the above quantity of silk, two cases will occur that will require a greater," The exactness, caution, and frankness of this gentleman are worthy of all praise.

CHAPTER VII.

Natural and Artificial Systems of Managing Silk Worms —Chinese System—General Remarks.

In the Silk Culture, there are two systems of managing worms—the *natural* and the *artificial*. The former contemplates a full exposure of the worms to a natural state of the atmosphere from the first, without any attempt to regulate the temperature. In the large feeding establishments of Europe, the latter system prevails. In China, the former is believed to be universal. Which system is best for us? To reach a proper and full answer to this vital question, I would remark:*

(1) The *climate* of China, in the same parallels of latitude, is essentially the same as our own. This is the testimony of travelers—our missionaries, and others. Dr. Peter Parker, one of the devoted missionaries of the American Board, and the native countryman who recently visited the United States, and who are referred to by Dr. Stebbins in the interesting communication that follows this, asserted the fact here named. And why should it not be so? We are situated in reference to all those causes that control climate just as China is. We have a vast sea-surface on the East, and so has China. We have a vast inland interior, on the North, North West, West, and South West, and so has China: and our *prevailing* winds are land winds, and so are the winds of China during the feeding seasons. Last February I wrote a letter to R. B. Forbes, Esq, of Boston, a gentleman of the highest respectability, and who has spent several years in the Chinese trade, proposing a series of questions connected with the Silk Culture of that country. Among the questions was this in regard to climate. In his reply he states, that in the neighborhood of Canton, sea-winds (the monsoons) prevail from October to May, and from May to October, land winds prevail; and that throughout the rest of China land winds prevail through the year. Of course, these winds coming over an unmeasured range of land surface as ours do, must be dry winds, like ours, making a dry climate in distinction from a humid one, like that of England; and making our climate and theirs essentially the same, in the same degrees of latitude. As then the Chinese have been engaged in the Silk Culture for some thousands of years, constituting, as it now does one of the great agricultural interests of the country, if not the chief one, the presumption is, that they have ascertained the best way of conducting it, especially on so simple, and at the same time, so *vital* a point as ventilation. But,

(2) Is it certain, that the Chinese practice the natural system?

Shut out from the rest of the world as China has hitherto been, it has been extremely difficult to get exact information, in regard to any of her

* I. R. Barbour.

industrial operations. They have been, as Mr. Forbes informs me, in the habit, and from system, of giving contradictory statements respecting all their domestic affairs, designedly to blind the eyes of foreigners. But on this point I think we may be sure, that we have reached the truth. Dr. Parker and his native companion before referred to, both stated to Dr. Stebbins that they feed in *open sheds*. And what is, if possible, still stronger, we have the testimony of the *Historical Paintings* described by Dr. Stebbins, at my request and given in another chapter. Here you see the *open shed*, with its busy occupants. These paintings—a splendid specimen of the art by the way—were drawn by a native artist, and were doubtless made to sell, and of course would represent the business *as it is*. They furnish, therefore, conclusive evidence of the point in support of which they are here referred to.

(3) The *artificial system* involves too much expense and care to be adopted by the great body of our people. A few individuals, or companies, may do it as the Messrs Chencys have done, and bring out decided results. And for their instruction, and as a matter of general interest to inquisitive minds we give the theory in progressive extent, together with the plates at the beginning of the volume which illustrate the system. But all the intelligent friends of the Silk Culture wish to see, and expect to see it engrafted upon the ordinary agriculture of the country; and of course, such a system of feeding must be presented to the public as is suited to such a design—as is susceptible of universal adoption. And for one, I hesitate not to say, that another long half century will roll over our heads, before the Silk Culture can become fully established, if we undertake to push the *artificial system* forward, as being the only one; or as in itself the best,—a point, by the way, in regard to which, I entertain very serious doubts, even if the question is not already definitively settled in favor of the *natural system* as intrinsically the best. One thing is very certain, and that is, that our climate is very different from the climate of the silk growing regions of Europe. From the causes already stated it is probably a drier climate. I fully believe it to be altogether better suited to the business. I so judge from the well known superiority of our raw silk, well reeled, and the superior healthfulness of our worms. In Europe the estimated loss by disease is from twenty-five to forty per cent. In this country, it need not be five per cent. In my own limited operations for seven years, it has never exceeded that in any crop carried through by the first of August. We therefore do ourselves injustice, by adopting, without due consideration, the theories, and usages of Europe in this matter. To Europe we may safely look for information on all the different processes connected with the manufacture of this precious commodity, but in regard to its culture, we must look to the results of our own experience, and the light that has come, and that shall hereafter come, from the Celestial Empire. And now that her massive doors have been thrust open, and her unbrotherly walls prostrated, and outside barbarians are permitted to look in upon her industrial affairs, may we not anticipate large accessions to the general stock of our knowledge, in regard to silk, and other agricultural questions? And in this connection, I cannot withhold a passing acknowledgement of gratitude to the American Institute of New-York, that they have with characteristic comprehensiveness of views, despatched a special Agent, with our Diplomatic Mission to that country, for the specific purpose of collecting, and transmitting to this country all the information he can gain, in reference to silk, and other questions. From the identity of climate, in the two countries, may we not anticipate large results to the agriculture of our beloved land—new modes of culture, new grains, grasses, fruits, flowers, and vegetables, and perhaps new domestic animals. The Hon. Mr. Cushing, the head of the mission, in a letter which I received from him a few days before he sailed, kindly assured me, that he would interest himself to the extent of his opportunities, in collecting and forwarding information on the silk question.

(4) As a general remark, in our feeding operations in this country, especially in the larger establishments, we have had neither the one system, nor the other: but a kind of *mongrel* system involving the evils of both, without the peculiar benefits of either. For example. Here is a cocoonery of the best class. It is lathed and plastered, or otherwise tight, so that you can at pleasure shut out the cold damp air, with appropriate fixtures for raising the temperature. It is also well ventilated, having say one-third more windows than an ordinary dwelling house. You hatch, feed and clean, according to rule. If it is cold, and your worms are torpid, you shut up, and raise the temperature, your worms eat and do well for a time, but in the last ten days they sicken and die, or at least make but half a crop. What is the matter? Why, in the last ages, you had a long cold rain, and your worms now grown large, required *ten times* as much pure air, as you gave them, or could give them, on the plan supposed. But suppose the weather was just the *reverse* of this, hot and sultry, the thermometer ranging from 80° to 90°, (at least 10° too high,) but you have provided no means to lower it. The external air is in a state of dead stagnation, not a breath stirring, every leaf motionless for one, two, or three days. You open your doors and windows, but this does not help the matter essentially, for there is no *circulation* of the external air, to drive through and change the air of the room: you have provided no *fans*, no artificial means of any kind to *stir* and *change* the air in the room, not even a scuttle in the roof to allow the deleterious gasses to make their own way out. Is this the artificial system? It is only a mockery of the thing, and yet I present this, not as a *caricature* but as a fair representation of the prevailing practice when artificial heat has been employed.

The truth is every tyro in feeding silk worms now knows, that we have altogether more to dread from *heat* than from *cold*, especially *hot, sultry, confined* weather. But for such weather none of our cocooneries have been fitted, and in feeding in them, or in any enclosed room, our only chance of getting a lot of 25 to 50,000 safely through, turns upon two contingencies. (1) That the thermometer, during their last stages, ranges

from 65° to 75° and (2) that we have brisk daily and nightly winds at the same time, so as to secure a constant *circulation* of the air *through* the room. In this case the impure air, generated by the breathing, and the insensible perspiration of the worms, and their animal excrements is expelled. Otherwise the most part of it remains in the room, to defeat all your labors and disappoint your hopes.

Every body knows that silk worms, like all other living things, need a pure air to breathe, and that their excrements, even if they are cleaned, as is usual, at each moulting, will vitiate the air of their room, more or less, according to the weather, and the amount of that excrement discharged. But every one does not know, that silk worms, like human beings and other animals, throw off through the pores of the skin, in the form of insensible perspiration, a large amount of the food consumed, yet this is a fact. In the last Report of the New-England Silk Convention. H. P. Byram, Esq, of Brandenburg, Kentucky, says:

"In order to show the importance of a *thorough* and *perfect ventilation* in feeding, I have this summer made the following experiment, to determine the amount of impure matter passing off from worms by insensible perspiration. I weighed twelve worms in the morning before feeding, weighed their food for twenty-four hours, then weighed the worms, and their excrements, and brought out the following result.

Weight of twelve worms, (a few days before winding,)	385	grs.
Weight of leaves consumed in 24 hours	313	"
Total	698	"
Weight of excrement deducted	101	"
	597	"
" " worms at the end of 24 hours	424	"
Showing a loss by perspiration of	173	"

According to the facts here established, 20,000 worms nearly grown, throw off, by insensible perspiration, over fifty pounds (Troy weight) of impure matter, every 24 hours. Crowd 50 to 100,000 of these *living*, *breathing*, *sweating*, *crawling* things into a close room with no *circulation* of the air, and who can wonder that they sicken and die?

(5) In numerous instances, myself and others have seen diseased worms, thrown out with the litter and exposed to heaven's pure air and drenching rains, restored to health, apparently by these very means.

(6) Almost every case of sweeping disease among worms that has come to my knowledge during the seven years that I have been engaged in the business, has been where a *large* lot was fed in an *enclosed building*; and in the last ages of the worm. Such disease has usually appeared after a few days of *cold wet* weather, the building having been, in the time, shut up to raise the temperature: but *more especially* after a few days of *hot, sultry, confined* weather: thus indicating, that the cause of the trouble is the *want of air*.

On the other hand, a few hundred, or two or three thousand may be safely fed in any common room, with ordinary care in cleaning and ventilating them.

(7) Some of the best cases of successful feeding that have come to my knowledge, have been where worms had the most air. General A. Holman of Bolton, Massachusetts, two years ago, fed a lot in an unoccupied barn, on the floor, setting the large doors fully open, so that the air could drive completely through. In very high winds, he would close the doors on the windward side. The result was decidedly good. With equal success, Mr. C. Mason, of Southbridge, fed some 20 to 25,000 in an old fashioned corn barn boarded open on all sides.

H. P. Byram, Esq., of Brandenburg, Kentucky, in a letter written last winter, says that a neighbor, Dr. Charles Stewart, the past season, fed a lot in an open shed, on branches, allowed them to wind in the same, and made the largest and best cocoons that he ever made. He says, the worms were frequently drenched with the rain; also, that the Doctor is so well satisfied that open feeding is the true theory, that he is now putting up a long shed, expressly for the purpose, and that many others there will adopt the same system. I might give many other similar instances. Within a few months I have received a letter from the Rev. Mr. Landfear, of Mansfield, Connecticut, and one also from A. Preston, Esq., of Willington, Ct., in answer to inquiries that I had made them on the subject. Both these gentlemen concur in the statement, that the prevailing practice in those towns has been to feed in out buildings, for fifty to sixty years, and yet from my own personal knowledge I am satisfied that their feeding rooms have generally been altogether too close. While they have dispensed with artificial heat, they have, at the same time, suffered in hot sultry weather for the want of *circulation* of the air. A still more decisive witness is J. W. Gill, Esq., of Mount Pleasant, Jefferson county, Ohio. In April last, he wrote me as follows:

"Your views relative to thorough ventilation are in accordance with my own experience—having been engaged for the past five years in all the departments, both growing and manufacturing. It gives me pleasure to announce to you, that I shall continue to prosecute my labors as heretofore.—During the past year I have much enlarged my operations, both feeding and manufacturing, and have furnished employment to about fifty hands on an average, the year round, and have manufactured upwards of $9,000 worth of silk goods, consisting of all the varieties of staple silk in demand, equal to any imported, and sold them readily as made, at a reasonable advance on their cost of production and manufacture. In fact, my efforts have been crowned with complete success, and I am rapidly and permanently enlarging my operations in all the various departments. In the past five years of my feeding operations, I have frequently met with partial failures and occasionally entire loss of lots of worms from extremely warm, close, and confined weather, (but never from cold.) I have tried all the plans of feeding and ventilating cocooneries used, or known in the United States. I found they were very deficient in accomplishing the objects desired, viz: cheapness and simplicity of construction, proper ventilation, cleanliness and economy in feeding. These objects are essential to the success of the business. After testing all the various methods and recommendations for

feeding and studying the nature, habits, and wants of the worms thoroughly, I finally studied out and adopted the following plan, which meets all of these important objects.

He then describes his open *tent*, and feeding cradle, which has been extensively published, and then adds:

"This system throughout, is simple, cheap, and easy of construction, and meets all the wants of the worm and greatly facilitates the feeding. It curtails expenses about one half, and more than doubles the quantity and quality of cocoons raised from a given quantity of eggs over the most successful results of the most improved method of feeding heretofore practised."

(8) I take it to be essential to this system of open feeding that it be done in the early part of the season; that the eggs be hatched, and the worms be fed *from the first* in a perfectly natural state of the atmosphere. I have little confidence in late feeding any way. My own experience and observation testify against it. And yet in frequent cases it does tolerably well. But the risks are greater, and the cocoons formed are always lighter and less valuable. My own wish is always to have the work all done up before the middle of August. But we are sometimes carried beyond that period from the want of early feed.

(9) Open feeding is the dictate of nature. The silk worm, in its native state, lives and passes through all its wondrous changes, on the tree, in the open air, like the caterpillar, the canker worm, and other annual insects. In this state it was found on the high hills of China seven hundred years before the birth of Abraham. In this state it has been found in this country, at least in Maine, South Carolina, and on Mount Holyoke, Massachusetts, one thousand feet above the level of Connecticut river. Can any, or all of the contrivances of art to promote health in this case do any good? I doubt it. True, in cultivating this insect, we must betake ourselves to shelves, or hurdles, or horizontal levels of some kind. For obvious reasons it cannot be done on the tree. On the tree the worm will instinctively shelter itself from the sun, under the leaf on which it feeds. It there enjoys Heaven's pure air in unstinted measures; and in return, takes all the changes of temperature as they come. If the thermometer falls below 60° it will become torpid, and refuse to eat, and of course will not grow. But upon returning warmth it revives, and goes on with all its wonted and wonderful labors, apparently uninjured by its temporary interruption. Is it not so with the honey bee, and house flies, and all insects that become torpid in a low temperature?

In cultivating the silk worm, therefore, we must provide ample shade, and beyond this, the contrivances of art, are, if I reason correctly, uncalled for, and had better be dispensed with. To ensure as much certainty of success in this, as in any earthly pursuit, all we want is *eggs from a healthy stock, ample and ripe food, perfect cleanliness, full shade, with heaven's sweet atmosphere essentially unobstructed.*

By what is called the *Artificial* process, pursued with extraordinary success at the experimental farm in France, under the direction of M. Camille de Beauvais and with the patronage of the government, the whole operation is much abridged in respect to time, and the quantity of silk produced from the same number of worms is considerably increased. The plan is to keep up an even temperature in the cocoonery as high as 75° Fahrenheit, and to feed the worms day and night to the full extent which they can be made to consume. I shall subjoin to this report a table most ingeniously drawn up, in which every step in the process is minutely and clearly detailed.* This, in my opinion, will be almost invaluable to the cultivator of silk, as condensing in a small compass, the most important and useful information.

The Messrs. Cheney, of Burlington, New Jersey, have experimented upon this artificial process, the last year, with success. The worms completed their winding in twenty-four days; and they have strong hopes to reduce the time required to twenty-two days. It is stated that, in proportion to the shortness of the time occupied in conducting the worm to maturity through the various stages, by incessant care, and the most liberal feeding, the quantity of silk is increased and its quality improved.

In the German pamphlet to which I have referred, it is stated that "by this mode of management, M. Beauvais has obtained from every half ounce of eggs, sixty-eight pounds of cocoons, whilst, in the south of France, they commonly obtained only twenty-five pounds, and in the north of Germany, with proper care, from forty to forty-five pounds." By this method, they can bring four generations of silk worms to spin in one year, and so have four silk harvests.

These are certainly great points to be attained. Such refinements in the cultivation, and so much pains-taking, may by some, be regarded as discouraging; but they involve no mystery, and the extraordinary advantages to be obtained promise an ample compensation for much expense and labor. How far they may be suited to what may be strictly called household arrangements, or where the silk culture is pursued altogether as an incidental or subsidiary branch of husbandry, is a matter of easy calculation, and which any one may determine for himself.†

The Messrs. Cheney have favored the public with an account of their experience in feeding silk worms, after the plan of M. Camille Beauvais. I subjoin it as a highly interesting and valuable document, and showing remarkable results. The cocoonery of Messrs. Cheney, at Burlington, New Jersey, which I had the pleasure of visiting, is on the most approved plan.

I subjoin a comparison of the two results from G. B. Smith, of Baltimore, to whose intelligence, activity and ability, in relation to this important branch of industry, the agricultural public are largely indebted.

"We followed, as near as circumstances would permit, the plan recommended by M. C. Beauvais, an account of which we have published, and succeeded in terminating the crop in twenty-four days; and we venture to say, that firmer and larger cocoons have not been produced by any silk grower this season. The silk reels admirably, and is strong, lustrous, and of a superior quality.

* Colman on the Agriculture of Massachusetts.

† See plates at the beginning of this work.

June 27th, the eggs were taken from the refrigerator, where they had been kept since the first of March, at an average temperature of 40° Fahrenheit. They were placed upon a shelf in the cellar, where the temperature was 60°. On the 29th, at 4 P. M., they were taken to the cocoonery, the temperature at that time being 78°. All worms found upon the cloths, upon their removal from the cellar, (being but a small number) were destroyed before the clothes were placed in the cocoonery. Eighty thousand worms hatched on the 30th of June, which we reserved for the experiment.

	Internal Temperature.				External Temperature.				No. of Feedings.	Wt. of leaves.	REMARKS.
Date.	6A.M.	12M.	6P.M.	12M.	6	12	6	12		lbs.	
June 30	78	78	77	78	70	78	70	68	18	2	
July 1	78	78	78	78	62	78	77	68	18	4	Morning cool—used heat.
2	76	78	78	78	70	77	71	69	18	8	The weather clear in the morning, and the worms lively; in the evening rain; wind S. E.
3	76	77	79	76	66	76	79	67		2	Worms commenced moulting.
4	75	76	75	75	65	76	75	60	12	16	Worms finished moulting.
5	72	72	76	73	56	70	72	60	12	22	Clear—wind N. W.
6	72	75	76	73	55	72	73	65	12	30	Wind E.—brisk fires during the day.
7	73	76	78	77	60	80	70	68		2	Commenced moulting.
8	72	77	78	75	65	78	76	70	12	14	Finished moulting.
9	74	76	77	76	66	78	76	70	12	30	
10	71	79	82	79	65	80	82	72	12	80	Clear—wind S. W.
11	76	82	80	75	71	87	74	68		6	Commenced moulting.
12	72	75	74	73	65	74	72	62	9	80	Finished moulting.
13	72	75	75	75	64	78	70	67	9	130	
14	72	75	75	74	68	76	74	67	9	200	
15	72	76	75	73	67	78	72	65	9	134	
16	70	75	76	72	64	79	78	64		10	Commenced moulting in the evening.
17	74	76	75	76	69	80	78	67			Quite dormant—not fed.
18	70	78	80	77	68	84	85	72	8	140	Finished moulting early in the morning.
19	72	82	84	79	68	88	90	76	8	260	
20	76	82	82	78	76	86	82	74	8	400	
21	75	79	78	78	73	80	76	73	8	680	
22	74	82	82	79	74	88	82	79	8	920	
23	75	79	82	77	75	82	86	75	8	600	Showed signs of winding—food diminished.
24	72	79	77	73	70	86	75	73	8	200	Commenced winding.

The worms were what is generally termed the "six weeks sulphur," and it will be seen by the above statement that they terminated their labors in twenty-four days. The amount of cocoons was three hundred and fifty-six pounds, and it required two hundred and twenty-five to weigh a pound. The amount of leaves fed out was three thousand nine hundred and seventy pounds, which gives eleven pounds of leaves to a pound of cocoons, and nine pounds of cocoons being required to produce a pound of silk, it will be seen that by this system of feeding, ninety-nine pounds of leaves only are necessary for one pound of silk."

"In the natural system, forty thousand worms consumed two thousand five hundred and seventy-six pounds of leaves; in the artificial system, one thousand nine hundred and eighty-five pounds. These worms produced one hundred and thirty pounds of cocoons in the natural system, and one hundred and seventy-eight pounds in the artificial. The cocoons weighed at the rate of three hundred to the pound in the natural system, and two hundred and twenty-five to the pound in the artificial. It required ten pounds five ounces of cocoons produced by the natural system to make a pound of silk; and nine pounds of those by the artificial. The forty thousand worms fed on the natural system made twelve pounds of raw silk; the same number, fed on the artificial system, made nineteen and three-fourth pounds. The natural system required an average of fully one week more time to produce the cocoons than the artificial system occupied."

CHAPTER VIII.

Description of Twenty-eight elegant Historical Paintings, illustrating the process of Growing and Manufacturing Silk in China, wholly by hand labor.

[For the following valuable paper we are indebted to Dr. D. Stebbins, of Northampton, Massachusetts. These Paintings are all executed on Rice Paper.]

A gentleman who has been long engaged in the Canton trade, and while at Canton had opportunities to become acquainted with the manners, habits and customs of the Chinese, has visited Northampton to become more acquainted with the state of silk culture here; from whose scrutinizing observations made while in China, much valuable information has been obtained. This gentleman has loaned the subscriber a volume of splendid Chinese paintings, which confirms our practice and culture of the Chinese mulberry (now called the Canton mulberry,) as correct and

proper. These paintings represent, on separate plates, all the successive processes of the business. You see the men, women and children, in their National costume, at work; commencing with the gathering of the mulberry seed, cleaning the same—preparing the ground—sowing the seed—transplanting the young seedlings—gathering the foliage—feeding the worms—heading or cutting down the plants near the ground, to sprout again and multiply the number of stalks and quantity of foliage. You see them making up the silk into skeins, as we import it, and the further process of flossing, reeling and winding the silk upon spools. The out-door men-laborers are dressed in plain loose frock and trowsers, or kilts, descending to the knees; some of the men with bare feet and legs, others of higher grade, with sandals and wooden shoes, adapted to their respective work. The women, boys and girls, are employed in gathering leaves, feeding the worms, reeling silk, &c. Some of the ladies for the interior labors, have elegant loose dresses of various brilliant colors, ornamented with wide embroidery around the neck and sleeves. The upper dress is loose, of gay colors, the sleeves large, something like that of American ladies at this day. The sleeves extend near to the elbow; all the ladies and females have pantalettes of various colors, each in contact with the upper dress. The countenance fair, delicate, and intelligent; eyes downcast. Most of the ladies have small feet and gay sandals; the hair neatly dressed, ornamented with flowers and jewelry, and all wear bracelets above the wrists.

For the gratification of those interested in the silk culture, I shall attempt a representation of these paintings to illustrate the mode of silk culture in China. By the plates, it appears that the Chinese sow the seed broad cast as we do small grain, which at a proper time they transplant into hills, like our Indian corn. The plants do not grow more than three or four feet in height during one season, and are cut down every year.

The subscriber imported the genuine seed from Canton in 1834 and 1838; and has several acres in great perfection, among which are many seed-bearing trees, which produce their fair representation as is evidenced this year (1843). During the visit of Dr. Perkins and his Chinese attendant to this country, they called on me, and were shown the Canton foliage, which was readily recognized, and which the Doctor and Chinaman said was of larger size than in China; and suggested that our soil was more congenial to its growth and developement than even that of China, its native clime.

The multicaulis foliage was exhibited, and the Chinaman replied "*too much big.*" The Chinese do not use the multicaulis for silk.

I have sent to China and procured another book of Chinese paintings on silk culture, and both volumes represent the *feeding to be open*, as we term it. I asked the Chinaman with Dr. P., if their worms ever became sickly, or stupid, and the remedy? *He opened his fan and passed it briskly over the table, to circulate fresh air.*

DESCRIPTION OF THE PAINTINGS.

Plate 1.—Represents a field of mulberries with ripe seed, growing from the foot-stalk, a peculiarity of the Canton mulberry, from one to four inches from the ground, and from stalks which had been headed down. Two laboring men are gathering and removing the seed, one sitting upon a low stool, gathering the mulberry seed, the other with a basket slung over his shoulder, removing the seed to be separated from the pulp.

Plate 2.—Represents two females busily employed, one seated on a low stool, washing and pressing the mulberries, the other standing at a table, separating the seed from the pulp, by pressing it through a bamboo sieve.

Plate 3.—Represents two men with naked arms and legs, dressed in loose frocks and trowsers, or kilts to the knees, with rude instruments in the shape of iron wedges with bamboo handles, picking up the earth preparatory to sowing the seed instead of using a spade or plough.

Plate 4.—Represents two men, one with water to moisten the clods, the other in a crouching posture, with a rude instrument, in shape, like a mason's trowel to smoothe the surface instead of the harrow and roller.

Plate 5.—Represents a man with his basket of seed, and sowing them broad cast.

Plate 6.—Represents the mulberry plants sprouted, and a man watering them, having spaces left to pass between the plants, has two tubs of water and a dipper with a long bamboo handle, that he may throw the water at a considerable distance.

Plate 7.—Represents the plants sufficiently grown for transplanting, and two men, one on his knees, or in a crouching position, taking up and bunching the plants, the other carrying them away to be set out again.

Plate 8.—Represents a field of mulberries, set in regular rows, apparently about two feet apart, and the same distance apart in the rows. *Quincunx* as we plant corn, with several stalks in a hill, one man wetting the bunches and handing them over to another person for setting out.

Plate 9.—Represents a woman and boy sitting on stools gathering the leaves into baskets, each leaf carefully separated from the stalk by the thumb and forefinger, to preserve the bud and extreme ends uninjured; the plants appear two or two and a half feet high.

Plate 10.—Represents the stalks deprived of leaves, except the ends of the leading shoots, and a man with a calabash of water and a ladle, distributing water over and about the roots of the plants, and another person setting plants in vacant places.

Plate 11.—Represents two females gathering leaves, the second time; the trees appear to have grown considerable since the first picking, with more and larger leaves; at this or the next picking, not only the leaves but the topmost shoot is taken off to check the growth and hasten the formation of wood; at this time the trees appear to be three to four feet high, entirely stripped of foliage.

Plate 12.—Represents a man with a crooked knife, heading down the mulberries near the ground, laying them aside, apparently for fuel to heat the small furnaces for reeling, &c.

Plate 13.—Represents the cocoons and millers in progress of maturity, and two females with gay attire, one sitting at a table covered with

millers selecting their mates; the other standing, even more gaily dressed, with her fan spread, and looking on with intense interest, the hair dressed with great care and neatness, wearing superb earrings and bracelets, broad lace around the neck and sleeves, and every female has pantalettes down to the ankles, like the men of higher grade; out-door men and laborers have trowsers or kilts to the knees only.

Plate 14.—Represents a female standing at a table with a bowl of *warm* water, the furnace at her side, pouring water upon the eggs to loosen them from the gum, and facilitate the hatching; and a boy, suspending the papers or cloths with the eggs on bamboo poles to drain.

Plate 15.—Represents a female sitting at a table, with a young child by her side, watching the progress of hatching the worms.

Plate 16.—Represents two females sitting in chairs at a table, one with a feather, scraping the worms from the paper or cloth on which they were hatched, on to bamboo oval trays, of the size of a large tea tray, with open work at the sides and bottom for the free admission of fresh air, the trays having been sprinkled with fine chopped leaves prepared by a boy sitting and chopping upon a block. The other female taking the tray for removing to the next process, representing the *first stage* of the worms on the leaves.

Plate 17.—Represents a female sitting at a table, distributing the worms upon the chopped leaves, to keep them separate and apart from each other, even in this early stage of feeding. A similar distribution is observed in every stage of feeding, in order to preserve the health of the worm, and that the sickly might be readily discovered and removed.

There is also a little urchin of a boy mounted upon a cage with puss in it, attentively watching his mother. This plate represents the *second* stage of feeding and size of the worm.

Plate 18.—Represents an overseer, in elegant costume, with his fan, pipe and handkerchief, instructing the boy sitting on a stool by a block, in the act of chopping leaves for the young worms, with a basket to receive the leaves. This is the *third* stage and size of the worm.

Plate 19.—Represents a man changing the worms from one tray to another, and placing them on leaves of full size, in such a manner that no two worms shall come in contact; another boy is in attendance to remove the trays to another place for feeding them secure from insects. There is represented a large *Canton* leaf with two worms of the proper size feeding thereon, being the *fourth* stage.

Plate 20.—Represents a lady placing the trays, with worms distributed on the leaves, upon standard frames, open to a free circulation of air, for feeding; and a boy handing leaves of full size from a basket; these frames have screens of thin gauze, to protect the worms from the annoying mosquitoes and other insects. On this plate, also, are represented large Canton leaves of full size, with worms feeding thereon, being the *fifth* stage.

Plate 21.—Represents a lady sitting at a table with worms on trays covered with leaves, the worms separated from each other, ready to be removed for winding, and another female with a tray of worms, removing them to be placed in the appropriate cells for winding, and the worms of full size apparently seeking a place to wind: this is the *sixth* stage.

Plate 22.—Represents a lady taking the worms, one by one, with her fingers, from the trays and placing them in separate cells formed of the bamboo, bent to an oval shape in frames, for winding, instead of permitting the worm to select a place for the same purpose.

Plate 23.—Represents a number of frames set up and the cells filled with cocoons, and a female spreading thick cloth before the cocoons, to exclude the light from them, as the worms are supposed to form more *perfect* cocoons in a dark room.

Plate 24.—Represents a lady with a pair of tweezers or chop stick, taking the cocoons from the cells, placing them on trays, and another female removing the trays to another place for separating the floss, by an easier, and more expeditious process, than when done by the fingers in a dry state.

Plate 25.—Represents a lady sitting by a small furnace, such as is common with us, with fire, and the cocoons in a vessel of water placed over the furnace, the lady with a pair of chop sticks in one hand to regulate the cocoons and with the other hand drawing the floss from the centre of the vessel, apparently through a small hole in the centre of something to keep the cocoons submerged, the floss passing over a small open frame or cylinder of bamboo sticks, which turning on its axis, is kept in motion by the floss in the shape of cotton batting passing over the cylinder, and through the fingers of the lady. It is deposited in a circle upon a tray by her side; a much better mode than the one used by us, and deserves a trial to preserve the floss valuable as any silk: The lady has by her side a stand and *tea-pot*, cup and saucer, and a pot of elegant flowers. There is a large vessel by her side with cocoons in water deprived of the floss and ready for reeling.

Plate 26.—Represents a lady sitting and reeling silk from the cocoons placed in a deep dish of water over a small furnace (like our clay furnaces) with fire underneath, having chop sticks in one hand to regulate the cocoons. The thread passes from the centre over a revolving cylinder, (of the same simple structure as in plate 25 for separating the floss) apparently through the centre and some contrivance to keep the cocoons from rising above the water which appears like soap suds, and probably cocoons would reel much better from soft water well soaped. From the fingers of the lady the thread is received on a reel, supported by a frame, the reel is turned by the left hand, another deep dish by her side filled with cocoons flossed ready for use—each dish appears to contain only the number of cocoons for the size of the thread wanted.

Plate 27.—Represents the long skeins of silk after reeling, hung on bamboo poles for drying, one lady handing them to a female who is giving the regular twist for skeins.

Plate 28—Represents a lady sitting in a chair—a large and high bamboo pole inserted into a block; near the top of the pole passes another of less size, bent in shape of a bow, one end has a string passing through a ring on the side of the bamboo and kept in a bent position by a sus-

pended weight. Near the lady are four bamboo sticks standing upright, each inserted into a heavy block over which is extended a skein of silk; (this is the reel) a thread of the skein passes over the other end of the bow and thence to the fingers of the lady's left hand and around upon a spool, turned by her right hand and several spools filled, stand at her right side, this is the last of the *historical plates of the book.*

The second book of paintings consists of twelve plates which, as a whole, illustrate the plan of *open feeding* in a different section of country from the first book. In this volume, it appears that there was danger from ants or other insects, as all the building are on posts over a body of water. The roofs are covered with palm leaf or some other material of warm climates. The sides and ends are open, to admit a free circulation of pure air. At each end are trellis fixtures and frames for receiving the oval trays with worms, for feeding six and seven tiers of frames in hight. The persons engaged on different operations are numerous, of small size, and appear very active and diligent. Each plate represents distant mountain scenery, with trees, shrubbery and splendid flowers in and about the buildings in pots. Each plate represents the different operations of labor requisite for perfecting the Silk Culture from the feeding of the worm to the reeling, twisting, coloring and weaving the articles of manufacture, all done by hand labor.

Plate 3.—Represents the feeding of worms upon the tree. On all the other plates the worms are fed upon the bamboo oval trays. The cocoons are placed in frames with cells for each worm.

Plate 8.—The frames as set up upon an angle of about thirty degrees, the tops join, and the bottoms spread, with a small furnace with fire under each pair of frames for stifling the grub.

Plate 9.—Represents the reeling, twisting and spooling, with very simple machinery.

Plate 10.—Represents the silk colored, wound on spools—winding from the spools over a cylinder in preparation for weaving.

Plate 11.—Represents the whole coloring process—rinsing and suspending the skeins on bamboo poles to dry, and the process of weaving.

Plate 12.—Represents the silk out of the loom, ornamenting with needle work, marking, &c.

Remarks.—Among the males and females in every process of the work, there appears to be different castes, or characters, and different dresses: some of the men have bare feet and legs, others with elegant slippers, some with wooden shoes, each dressed according to the work to be performed.

The same difference of dress exists among the females. Those distinguished by small feet have the most elegant and splendid dresses. The females whose feet are of the natural size, have thick shoes, and more plain dresses—but all have bracelets on the arm,—ornamented ear-rings, and the hair dressed with peculiar neatness, ornamented upon the top and sides, with elegant flowers or jewelry, but no combs to be seen.

The whole process of making silk, from the preparation of the soil, is done by hand labor with the most rude tools and reels.

Although labor in China may be ever so cheap, (and their support is almost nothing, as the people live chiefly on rice) yet if they grow silk to any advantage, it does seem reasonable, that with Yankee ingenuity,—enterprise—industry and machinery, we may compete with them or any other Nation, in this business. It will be recollected that in China, France and Italy, the raw silk is furnished and made in families, by individual exertion,—and so may we, and sell it to the merchants or manufacturers.

By the foregoing it appears, that the Chinese during the operation of feeding were very careful in keeping the worms from being crowded, and to give them a natural atmosphere.

CHAPTER IX.

Is our Country adapted to the Produce of Silk?—Reasons why the Business will be Profitable.

Is there any thing in the nature of the case—in our soil, climate, or in our institutions, that will prevent complete success in the culture of silk?*

1st. We are in the same latitude with those countries that are the most successful in its culture and manufacture.

2d. We are not only in as good a latitude, but our *climate*, in the same latitude, is much better than the climate in a corresponding latitude in the old world for the growth of silk, as all testify who are competent so to do.

3d. No man can doubt but our soil is fully adapted to the growth of the mulberry; and wherever there is a pure atmosphere, a good supply of food, and the requisite attention, silk-worms will live and prosper. We have this pure atmosphere, we can raise a supply of food, and it would be a libel on the character of our countrymen to suppose, for a moment, that they are not capable of giving the requisite attention to any business they undertake.

4th. It is the uniform testimony of those who are qualified to judge, that we *can* become a silk-growing people.

It is admitted by all, that there is nothing in the nature of the country or its inhabitants, that will prevent a successful and perfect prosecution of this branch of industry. If, then, every thing goes to show that it *can* be cultivated, another question will very naturally arise—

CAN IT BE DONE PROFITABLY?

Your Committee are of the opinion that the culture and manufacture of silk, in all its branches, can, *profitably* to those engaged in it, be introduced in this country.

1st. The experience of all who have engaged in it to any extent, shows the fact. The people of some parts of Connecticut have pursued the business for nearly a century past. Would they have continued the business if it had not yielded a profit? In the town of Mansfield, in Connecticut, which is exceedingly barren and unproductive in the usual products of the soil, the culture of silk has, for years, composed the principal business; and the fact that they have *continued* the business, proves that, to *them*, it is profitable; and to the profit yielded in its cultivation they

* Report of Mr. Bliss to the Legislature of Ohio.

owe much of their prosperity. We refer to the testimony of Mr. Gill, in another part of this report, and to the testimony of others in this State, whose communications are herewith published, to sustain this point. Experiments have been made within the last few years, in different parts of the country, in almost every variety of circumstances, that go to prove, beyond doubt, that it can be made profitable to *individuals*, and to our whole country, in the aggregate.

2d. It will not be doubted that the silk manufacture is profitable in England. Yet she does not produce a *pound of raw silk*. She cannot raise the silk worm—the humidity of her atmosphere supposed to be the cause—yet, while she is under the necessity of importing all of her raw silk, she manufactures, *profitably*, to the amount of $75,000,000 annually. We have this advantage, that we can *produce our own raw material*, and successfully manufacture it. In France there is also more manufactured than is produced at home; and they import several millions annually of raw silk. Our advantage is, that we shall not be under the necessity of taking our gold and silver out of the country to pay for the material; nor have we to pay duties and other expenses of importing it. All these items take from the cost of the article when manufactured, and of course all *other things* being equal, it can be manufactured at a greater profit here than in England or France.

3d. As a further evidence that it can be profitably entered into, it will give employment to much of the labor of the country that is now unproductive. The aged person, whose three-score years and whitened locks have exempted him from the performance of the ordinary labors of the day, may furnish for himself a profitable employment, and at the same time, an amusement, in feeding and caring for the silk-worm; while children, of both sexes, who could in no other business be a source of profit, can do many things connected with the culture to as much as or more advantage than persons of mature age. So much is a *clear gain*. It is bringing so much labor into existence; and the profit of this labor is a clear saving to the person to whose use it is applied. And further, it promotes a profitable and pleasing labor for the females of our country. What more delightful employment can they desire than the raising of the silk-worm and the reeling of silk? The time once was, when the music of the spinning-wheel was heard in every cabin, and in every farm-house, while the matron of the house could be seen at the loom. But that day has gone by; and the shuttle is now only thrown by the power of steam or the force of the water-fall, while the music of the spinning-wheel would scarcely be recognized amid the Babel sounds of a manufactory. We have, as yet, no substitute for those employments with which our mothers were familiar.

The Silk Culture will fill a vacuum that has too long existed. It will furnish pleasing labor for the female portion of almost every family that is disposed to pursue it. And this portion of the family, whose labor has, from the nature of the case, been before in a manner unproductive, by this means will yield a direct revenue to the pockets of those to whom they look for protection and support. The following extract from the memorial of a lady of Tennessee, to the Legislature of that State, undoubtedly speaks the sentiments of many among us:

"We would remind their honors that female labor, in this country, is nearly prostrated; that since the existing improvements in carding, spinning, and weaving, by machinery having taken place in the United States, the labor of females in those branches of domestic industry is reduced so low, that there is but little inducement to follow them except to make clothing for ourselves and our households. In bygone days, we could, by industry, not only provide clothing for our households, but could make a sufficiency of domestic manufacture to spare, to sell to the merchants to procure other necessaries for our families. This is not now the case; when we manufacture these articles now, and take them to the merchant, we find them supplied with domestic manufactures from the Northern and Eastern States of the Union, at so low a price, that we cannot bear a competition with them. We belive that our time would be more profitably employed in the culture of silk, and that if the General Assembly (as most of the States of the Union have done,) will give a premium on cocoons, sewing silk, and raw silk, so as to encourage our daughters, and domestics, and others, to engage in this branch of industry, it would be the means of improving the prosperity and happiness of our households, and ultimately add much to the wealth and prosperity of the country."

It is evident, then, that that branch of the culture which can be carried forward by private individuals and families may be made profitable; that it may be in a great measure, the product of labor, which would be unavailable in any other business.

Fourth: Another ingredient that should enter into our estimate of the probable profit of the culture, is the fact, that the production of the raw material does not necessarily occupy but a small portion of the year, while in estimating the profits of other kinds of business, we start upon the presumption that the whole *time* is occupied therein. From this fact, that but a small portion of time is occupied of each year; and, the fact, that most of the labor may be done by the aged and infirm, and by children and families, if they have leisure, every farmer may raise from *ten* to *one hundred* pounds of raw silk, annually, without the investment of one cent as capital, and without adding to the expense, or diminishing the products of his ordinary farming operations.—This being true, no one can deny but there would be profit in it. In connection with this branch of the subject, we will state a fact that is now before us. In the year 1834, in Venetian Lombardy, there was $16,002,606 worth of silk reeled; and this was done by 80,000 persons. Each person then reeled, on an average, $200 worth of silk. This was *all done in five or six weeks;* while the balance of the year was occupied with other and their ordinary avocations. Had they raised the cocoons, as well as reeled the silk, it would have been *to them* the same as the *coining* of $16,002,606 in gold and silver. This gold and silver would have been the product of their labor. But allowing them 20 per cent. for reeling, it is then true, that they earned

$3,300,000, in that short space of time. It is then an important subject for consideration, that the time is short necessary for the production of the raw silk.

Fifth: It is an evidence that it may be made profitable, in this country; that it is, *in fact*, profitably carried on in other countries, where the people labor under great disabilities, with which we are not at all encumbered. It is produced at a profit, notwithstanding every product is heavily taxed. Every pound of cocoons, and every pound of raw silk, is taxed; and it is stated, that in the Neapolitan Territory, every mulberry tree is taxed, annually, about sixteen cents. If the people there can sustain themselves under these heavy burdens, and make the business profitable, shall we, with all our enterprise, admit that we cannot, when every thing connected with it, is as free from taxation as is the air of heaven?

Sixth: It is made profitable in countries where the soil and climate are not as well adapted to the culture as with us. In calculating the profits in other countries, a deduction is always made on account of a *certain* loss of a large portion of the worms. This arises from negligence, or from the climate, probably the latter. In many places where it is carried on *profitably*, a loss of from 30 to 50 per cent. is always sustained by the death of the worms. In this country no such loss need be calculated upon; a loss will sometimes occur from negligence or mismanagement. But it is believed, as a general thing, that the loss can be brought below five per cent. Our climate is so pure that a loss in consequence of its influence is not necessary. If then, those who must necessarily sustain such losses can make it profitable, cannot we, who are subject to no such disadvantages?

Seventh: Another consideration of a good deal of weight, looking to its probable profit, is the fact of the *uniformity* of its value every *where*, and at all *times*, and the facility with which it can be transported. It will command its present price, or about that price, as long as the supply does not equal the demand. There are times, when the ordinary productions of the farmer yield no profit at all. The market is glutted. There is no demand for the article, whatever it may be, and as a consequence his pork, beef, corn, and grain of every description, are so low as not to pay the cost of production. Not so with silk, either in its raw or manufactured state. The supply cannot, for many years, equal the demand, if ever. It has a uniformity of value, and that value is measured by its weight. In this particular it resembles the precious metals. It has a value, because it will always command specie or its equivalent. It is, in fact, a very good substitute for it for all practical purposes, and, certainly, a much better representative of it, than that which forms the most of our circulation. It is a matter of no small importance to the farmer, that without any outlay of money, or any additional help, he can, in a few weeks time, raise *something* that is always as good to him as gold in his pocket. He can have it worked up into clothing for his family, and thus save the money that he lays out for the same material; or, with it, he can procure his tea, sugar, coffee, and all the variety of things necessary for every family to purchase; or he can get the cash to lay by for a rainy day. And it is not like taking a load of hay, wheat, or potatoes to market, for the value of a load of each of those products can be carried in the work-bag of the good woman, and the matter is got along with without any trouble or expense. The merchants will, of course, be always glad to receive it for goods, as they can take a few hundred dollars worth of it to the Eastern cities, if necessary, with more ease than the same value in silver.

Eighth: But it may be objected, that the price of labor being so high, we cannot compete with those countries where the price of labor is much lower. To this might be set off the *fact*, as in all respects conclusive, that experience has already demonstrated, that, notwithstanding the price of labor, we *can* compete with these countries in which the price of labor is low. But we go farther. In this country the price of labor, to a considerable extent, need not enter into the calculation, as we have seen, that the raw material can be produced by the farmers of the country, without *any additional* expense for labor at all. It will be done by labor that at any other business is not available.

Thus the produce of silk *creates* the labor that produces it. It adds the product of so much *additional* labor to the country; and *to the extent* that it does so, it is a *clear profit* to the country. But facts go fully to demonstrate, that it does by no means follow, that, in countries where labor is low, the product of this labor can be afforded *cheaper* than where greater wages are paid. The price of labor generally depends upon the *industry* and *skill* of the laborer. We can afford to pay for labor what that labor is worth to us. If, owing to the industry and skill of the laborer, a certain amount of labor gives us a product of a given value, we can, of course, afford to pay more for the labor than if the product was only *one-half* that value. And is it not a universally admitted fact, that industry and skill, and consequently an increase in the product of any given amount of labor, go hand in hand with high wages; or, rather high wages evidence the fact, that this industry and skill exist, and that the product of a given amount of labor is *worth more* than in the other case?

And besides, in those countries where labor is low they are surrounded with difficulties that do not affect us, which would counteract any advantage that they might have from the low price of labor. Their taxes on production are enormous, and they are compelled to calculate upon a certain loss, by disease, of a large per cent. of their worms.

England can furnish manufactured silks as good and as cheap as France and Italy—although she has to import *all* her raw material, and the other countries have the double advantage of being able to raise their own raw material, and that wages are lower than in England.

Holland can furnish linens cheaper than they can be furnished in countries where wages are lower. France can furnish woolen goods cheaper than Spain, while her price of labor is higher.

And what is, perhaps, of as much importance as any thing, is the fact that in countries where wages are extremely low, it is next to impossible

to introduce any improvements. The work, from the picking of the leaves of the mulberry, to the finishing of the finest silks and satins, is mostly done by the slow process of hand labor. In countries where wages are high, (and it would be so in this,) the *skill* of the citizen is brought into requisition, and machinery springs into existence to the aid of the laborer. And who can doubt that in this country the time will soon come when machinery, as complicated and as perfect in its organization, driven by the power of the elements, as that now appplied to the cotton or woolen manufacture, will be applied to the manufacture of silk?

We close this part of the subject with an extract from the memorial of Mr. J. W. Gill, presented to the Legislature at its present session, which is a strong illustration of the point under consideration. He says:

"Influenced by such reflection on these subjects, and the great benefit that would accrue to my country, if they could be brought into practice and successful operation in a systematic manner, I concluded to devote a portion of my time and capital to a practical test of this business, which, for four years past, I have pursued, as per annexed scrawl.

"In May, 1838, I purchased and planted one thousand Multicaulis, and three thousand Italian mulberry trees, at a cost of about $400. That season fed a few, say ten thousand worms, by way of experiment, and was very successful. Let the roots from multicaulis stand out during the winter, and they were generally killed by the frost. In April and May, 1840, I purchased and planted twelve hundred multicaulis and two thousand Florence, at a cost of about $800. These trees increased ten fold. At the same time I contracted for the production of one acre more, which produced three thousand two hundred multicaulis, at a cost of $460. At the same time I contracted with John Fox, senior, and three of his family, all experienced and skilful machinists and silk manufacturers from London, for one year, at a cost of $720, and during the same year, they, with other assistance, constructed a number of looms, harness, and other machinery and manufactured about $1,090 worth of silk velvets, hat plush, &c., from cocoons of my raising, and purchases made from this State and Pennsylvania. I had but partial success raising cocoons that season, owing to the loss of two hundred thousand fine, healthy worms, after their fourth moulting, caused by the neglect of a person to properly ventilate the room and feed them during a few days of my absence. In November, 1839, I purchased twelve thousand two hundred multicaulis trees, at a cost of about $600, making in all, at that time, forty-two thousand six hundred trees, which cost $2,260; from which I sold four thousand six hundred for $1,400, leaving on hand thirty-eight thousand trees, at a cost of $800; and by September, 1841, they had multiplied to about one hundred and fifty thousand in number, and covered thirty acres of ground. During 1839, '40 and '41, I constructed three cocooneries, worth $1,200, and a factory three stories high, forty by sixty feet, worth $1,100. Cash value of engine and machinery, September 1, 1841, $3,200,

"Since then, I have added much additional machinery. During the past year I was completely successful in my feeding operations, and produced eighty bushels of good cocoons, and had foliage and room sufficient to have produced double that quantity, but could not procure silkworm eggs. During the past two years operations in the silk factory, we have made thirty-five pieces of velvets; length from ten to twenty-four yards. each, value from $4 to $6 per yard; ten pieces of plush, from which we made twenty-four dozens silk hats, worth $48 per dozen; one hundred pieces of dress silks, flowered vestings, &c., varying in length from ten to thirty yards each, and worth from $1 to $3 per yard; also, sixty dozen cravats and pocket handkerchiefs, worth from $1 to $1,75 each; and for all of which I have found ready sale.

"Since September last, we have twenty hands regularly employed in the factory, who, with the machinery I now have, manufactured, daily, from the cocoons, about $30 worth of goods. I have about six months stock of cocoons on hand, which I have obtained principally from this State, New-York and Pennsylvania, where a bounty is given to encourage their production within the last year.

"My establishment has been sufficiently complete and successful to repay the outlay for stock and labor in manufacture, and yielding a small profit on capital invested. The more I become acquainted with the business, the more sanguine do I feel of success. I have had many obstacles to contend with, such as my own inexperience, the opposition of friends, and the impositions of speculators in machinery, trees and eggs, want of proper workmen and materials to construct machinery, and every other difficulty attending a new and complicated enterprise.

"I have succeeded in establishing the first regularly organized silk factory ever put in operation in this State, or the United States, that purchases all the cocoons and reeled silks, from whatever part of the United States it may come, and manufactures the same into dress goods. I have practically demonstrated to the citizens of Ohio, and of the United States, that this country can manufacture silks, as well as produce the raw material; and I believe this business will soon become more lucrative to our producers and manufacturers than either the production and manufacture of wool and cotton."

At the close of the following chapter will be found a Table of the Exports and Imports of Silk, prepared *expressly for this work*. The chapter is a continuation of Mr. Bliss's Report, in which the importance of the culture of this article is still more strikingly illustrated.

CHAPTER X.

Imports—Consumption—Market—Importance of the Culture of Silk—Labor—Legislative Aid.

For the last five years, we have imported, on an average, $18,000,000 worth of silk goods annually. This, in addition to what is raised here, is consumed among us. There can be no doubt but the market will be good until we can manufacture an amount equal to that which we import for consumption. Our imports will, in fact,

always be just the amount that the *consumption* of the country exceeds its *production*.

The consumption of the article will increase in proportion as its product increases among us. Silk enters already very largely into the clothing of the people. It is used more or less in every family; and while it can be had it will not be dispensed with. It is reasonable to suppose, as the article of silk, for which we now send our gold and silver to Europe, becomes more and more the ordinary products of our labor, that a much larger *proportion* will be used for clothing than is now used. Thus, when we are able to produce an amount equal to our *present* imports and our *present* consumption, the increase in our consumption will furnish a market for an amount equal to the present imports, and an addition to it to an amount equal to the increase in our consumption.

But when we are able to supply the demand for home consumption, we need not stop at that limit for the want of a market. The heaviest of our imports are from Great Britain, and will continue to be so. For all that we purchase of her, we must pay in some way. If we have nothing else that she will receive, our gold must go for the purpose. England manufactures $75,000,000 worth of silk goods annually. She makes them, of course, to sell; but in the first place, she has to *buy* every pound of the raw material, as she cannot raise it. She can make a profit on the manufacture, and as long as she can do this, she *will have* the raw material, if it is to be had. If she can get it in no other way, she will pay the money for it. But she will get it where she can do it at the best advantage; where, instead of paying the money, she can *exchange* her *own products* for it. Are not the commercial relations between that country and ours such that she will be likely to buy of us if we can furnish her? She purchases the value of from fifteen to twenty millions, annually, of raw silk. She will buy it of us if she can pay us as easily as she can pay others for it. Here, then, will be a new market opened. The same may be said of France, as she purchases the raw material to the value of several millions annually.

But there can be no doubt on this point: We *cannot* produce enough to supply the markets that will be opened to us, and not enough to affect materially the price of it. The demand will keep ahead of the supply. If, then, we can cultivate the growth of silk, and do it successfully and profitably, and can find a market for all that we can produce, it may be very proper to inquire into

THE GENERAL IMPORTANCE OF THE CULTURE.

On this point of the subject, a boundless field of inquiry is opened. Your Committee being, none of them, personally engaged in the silk business, and not having given the subject much attention, can only suggest such considerations as are the result of limited reading and reflection on the subject. But they beg leave to suggest a few considerations why, in their opinion, it is exceedingly important to the interests of the country that it should become a leading branch of national industry.

The wealth of a country is the product of the labor of that country. Individuals may become wealthy by speculation, and by various means other than by labor; but all that is obtained in this way by one, is taken from the pockets of others, and there is no increase in the aggregate. But the *labor* of a community will *produce* something *valuable* as its necessary result: that is, of course, when the labor performed has that for its object. The wealth of a country will increase in proportion as the products of its labor increase. Every man can, by his labor, *produce* something; and every additional amount of labor, when rightly directed, will give an additional product. To this product will be attached a certain *value*; and it follows that every product obtained from the additional LABOR of the country, must add something to the aggregate wealth of the country. There can be no doubt but a large amount of the raw material of silk may be *produced* in this country by labor that in any other business would be unproductive. Most of the labor can be performed by aged persons, children and females, who, without this employment, would produce little or nothing. In fact, the aged and the children would be a tax upon community to the amount of the cost of their support. There are in the State of Ohio 1,500,000 inhabitants. Supposing that, on an average, each family consists of *five* members there are 300,000 families in the State. Reducing this again to one-fifth, would leave 60,000. Does any person doubt but there are 60,000 families in the State of Ohio that can produce, each, ten pounds of raw silk every year, without the *cost* of any additional labor? It can be produced mostly by labor that would otherwise be unproductive. On this supposition, the product of the 60,000 families would be 600,000 pounds of raw silk. This, at $5 a pound, would be a product of $43,000,000 to the people of the State. But, while there are 60,000 that can produce ten pounds each, there are one-half that number that can produce twice that amount. This would give an additional amount of 300,000 pounds worth $1,500,000; in all, a product worth $5,500,000 to the Public. This could be done, and the products of the State in every *other* particular, be as large as they now are. This would as really be an addition to the wealth of the State as though the amount were *coined* expressly for her benefit. It is the product of labor otherwise unproductive, and so much clear benefit to the people.

But look at the same calculation for the whole Union. We have 15,000,000 of people. One fifth of that number is 3,000,000, and one fifth of that number is 600,000. A product of ten pounds, each, would be 6,000,000 pounds; at $5 per pound, it would be $30,000,000. This is the raw material; and this is made without any reference to the vast numbers who will make the silk culture their business, and who will consequently produce a much larger amount.

But further:—as soon as the raw material is produced, manufactories will be established throughout the country. The only reason that they have not hitherto increased, is the fact that the raw material could not be procured to work up. Manufacturers are only waiting for this. When we can manufacture our own product of the raw material, we shall of course *save* to the country the *profit* arising from the manufacture.

The above calculations may appear extravagant and visionary. But from what little examination we have been able to give the subject, we are persuaded that the estimates are too moderate, rather than otherwise. Mr. G. B. Smith, of Baltimore, a gentleman in whose opinions all who are interested in the culture will have great confidence, in a number of the Silk Journal, says: "But let us make a calculation, for the farmers' domestic use, for the production of silk as a domestic article in all our farmers' families, whence the invention of machinery has expelled the spinning-wheel, and where very little profitable employment has been left to the females and junior and senior members. Suppose the farmer has an acre of ground planted with 5,000 trees, his children gather the leaves, and his daughters feed and attend to 80,000 worms. This they can do without materially interfering with any other arrangement of business or pleasure. They then reel the cocoons during their hours of leisure, and the result is twenty-four pounds of reeled silk the first year the trees were planted, worth to them $144, without a cent of cost, or the addition of a cent to the expenses of the farm." If this calculation is a reasonable one, ours is certainly not extravagant. Much might be added to it, and then fall far below the point beyond which we shall not probably go.

But farther—the following is a statement of our exports and imports, from 1833 to 1841, inclusive.

Years.	Exports.	Imports.
1833	$90,140,433	$108,118,311
1834	104,336,933	126,521,332
1835	121,793,577	149,893,742
1836	128,773,040	189,980,035
1837	118,419,376	110,980,177
1838	108,486,616	113,717,404
1839	121,028,416	162,092,132
1840	131,581,950	104,804,861
Total	$923,340,381	$1,096,111,024

It will be seen, that the balance against us, in the eight years, is *one hundred and seventy-two millions seven hundred and seventy thousand dollars*. To this enormous extent, there was a debt created against us. We *bought* more than we *sold*. And to pay this debt, the precious metals were taken out of the country, and the necessary result was pecuniary embarrassment. This will always, necessarily, be the case, when we send our money out of the country, whether for the purchase of goods, or for any other purpose; as long as we can, pay for what we buy with our own products, our money remains with us, and is used as a circulating medium. The only remedy for the evil is, either to *buy less* or to *sell more*, or perhaps both. The excess against us, caused by the excess of our imports over our exports, for eight years is as is above stated. From 1835 to 1840, inclusive, the balance against us, was $132,607,723; and, during the same period, we imported silk to the amount of $105,992,190, or nearly $18,000,000, per annum. We have paid so much for silks which we might as well have produced ourselves. The money so paid is a loss to the country. In 1839, we purchased of other countries, silk to the amount of nearly $23,000,000, as follows:

Silks from India and China, piece goods	$1,738,509
" " sewings	50,650
" sewings from other places	78,884
" raw silk	39,258
" from other places than India, veils, shawls, &c. &c.	345,490
" other manufactures from other places than India	18,685,295
Manufactures of silk and worsted $2,319,884, (allowing one half the value to be silk,)	1,159,942
Total	$22,838,028

The importations of silk are one-fourth more than of any other article.

The amount of cotton manufact's imported was	$14,692,397
Of iron	12,051,668
Of cloths and cassimeres	7,025,898
Other woolen manufactures	3,507,161
One half the value of silks and worsteds	1,159,942
Total woolen goods	18,831,907

The amount of silk nearly equals that of woolen and linen together, and is equal to one half of all other fabrics conbined. Is it not then an important consideration, that this expenditure be saved to the nation! Abstract the article of silk from the catalogue of imports, and our indebtedness would be trifling. But in addition to the debt incurred by our annual purchase, there is the interest on the loans made by the States, of $12,000,000 a year to be met, and an enormous debt of $200,000,000, being the loans themselves that must be paid some how or other. How can it be done? *It can, every cent of it, be paid by our exports of silk.* After raising enough for home consumption, the world is then open to receive all that we can produce.

In the Burlington N. J. Silk Record, for Jan. 1842, it is stated, that

"In England the importation of raw silk, from the year 1821 to 1828, was 24,157,568 lbs.; which, when manufactured, was worth £120,770,580 sterling; and the hands required for its manufacture were more than 400,000. This sum is equal to $536,222,237! or $76,190,462 each year. Of this amount, Italy alone furnished $59,881,233. In 1835, Great Britain consumed, at wholesale prices, to the value of $28,282,582 of manufactured silks. The sum paid to weavers alone, not taking into the account what was paid for throwsting, winders, doublers, drawers, warpers, the soap, the dye-stuffs, and to various mechanics, was little short of $14,000,000; the amount of silk goods, now produced in that kingdom, is stated to be *seventy-five millions of dollars!* But they raise not a pound of the *raw material.*

"France manufactures $28,000,000 of silk, and imports of the raw material from eight to ten millions of dollars worth. She could manufacture annnually $50,000,000 worth, could she procure it. England and France, in common with all civilized nations, are competitors for this precious material, wherever found; but especially Germany, Prussia, and Russia, would enter the field, making annual demands upon us, could we supply them, for from 50 to 100,000,000 lbs.!"

We can export *nothing else* that will accomplish the object. We can raise grain, but where shall we find a market for it? The product of our cotton fields already equals the demand for it; and in a little time longer, when its cultivation becomes more extensive in British India, there will not be a market for all that we now produce.

Another reason why it is important, is, that the profit of its cultivation does not at all depend upon the perfection of our system of Internal Improvements. It is of such a nature, that the same facilities for transportation, that would raise the price of almost every other product, would not sensibly affect this. Our system of improvement by Railroads and Canals, is already so perfect, and our facilities for transportation so great, that this view of the subject can hardly be appreciated. Every farmer knows that his wheat is worth on his farm just as much less, than at the place of market, as it *costs* to get it to market. A market is now furnished for wheat (although not so with most kinds of farmers' produce) at almost all points on our Canals, Railroads, Lakes, or navigable rivers. If wheat is worth one dollar per bushel at either of these points, it is worth less to the producer, in proportion to the distance he lives from the point. If he lives ten, twenty, forty, sixty, or one hundred miles from the point of market, his wheat is worth so much less than a dollar as it costs him to get it to market. The price of raw silk would not be thus affected, because it would cost comparatively nothing to get it to market. Suppose the wheat-grower lives one hundred miles from market—he takes fifty bushels of wheat into his wagon, for which he expects to get fifty dollars. It cost him fifteen dollars to get the wheat to the place where it is worth one dollar per bushel. His wheat yields him one dollar, less the cost of taking it to market, which is thirty per cent. His wheat at home is worth seventy cents a bushel.

The load of wheat would weigh about three thousand pounds—worth at market fifty dollars. The same load, if it were raw silk, would, at five dollars per pound, be worth fifteen thousand dollars. It would cost the same to carry it one hundred miles, which instead of being thirty per cent., would be about *one-tenth of one per cent.* The cost of transporting it being very trifling; the article would, as a consequence, be worth nearly as much at any point in the interior of our country as at the point to which it may be necessary to transport it; and any person who will make the calculation, can see that all the raw silk that can ever be raised in the State of Ohio, can be carried, in a wagon, to the city of Boston, at a less per cent., than the wheat crop can be carried, in the same way, a distance of twenty-five miles.

But we have already dwelt longer upon this point than we intended. Every man must admit its importance to the interests of the people. It opens a sure road to wealth. In order to lead every man to consider the subject, and to persuade the people, generally, to go into it, it may be necessary, in the infancy of the culture in this country, to offer some further inducement, to in sure a fair commencement of operations. We then ask, IS IT NECESSARY TO GIVE A BOUNTY ON ITS PRODUCTION.

It has been truly said by a writer on this subject, that "every new enterprise, of whatever kind, or wherever undertaken, has its initial difficulties, and that which is the result is attended with the most profit has, at commencement, usually the greatest number. The history of new undertakings would form one of the most interesting and instructive works that was ever presented to man; and now, when enterprise and perseverance are not, perhaps, the preponderating virtues among our species; when enthusiasm is often observed to be suddenly quenched in disappointment, and the cry of humbug is raised to screen the stupid miscalculations of one class, or the want of intellectual perceptions in another, any attempt to inspire courage and confidence, where such can be made available to the public interests must naturally contribute to the sum of human happiness.

It is believed, that the most sure way of inducing the people, generally, to commence the culture, is to offer a reasonable bounty to the producers.

It is a *new* business. Our farmers raise their wheat, corn, and potatoes, and their other ordinary productions, year after year, and are satisfied if the crop is *usually* productive and the price is *usually* good; but it is with difficulty that they can be persuaded to encounter the seeming hazard of entering into a *new* branch of cultivation. This is the reason our farmers have not already more generally turned their attention to the subject. If a small bounty is offered as an inducement, they are led to look at the subject. Being sure of realizing *something* from an attempt, and thinking that the amount of the bounty will at least pay them for trying the experiment, they commence cautiously. By a careful trial, they become satisfied that they *can* make it profitable *without* the bounty. The bounty offered first induced them to make the effort; and after having made the trial, they are fully satisfied that it can be made profitable—a *fact* which they *would not have learned* had it not been for the bounty offered. This, in itself, is a sufficient reason why a bounty should be given. In France, and in other countries, where the silk culture is already, perhaps, the most important branch of national industry, and where, from the fact that it is so profitable, it is rendered of national importance that it should be fostered—it is encouraged in this manner. Although all the difficulties of the *commencement* are past, yet, by the offer of large premiums, and by other inducements, the culture increases in amount, and the products improve in quality. This is the course frequently taken to enlarge the increase in the product of any particular article, which it is greatly for the public interest to produce. In the year 1837, the State of Maine offered a bounty, to the wheat-growers of the State, of two dollars on the first twenty bushels raised, and eight cents a bushel for all above that amount. The State authorities saw that this branch of industry was languishing, and that, as a consequence, the money of the people was sent abroad for bread, when she could as well have produced it herself. The offer of the above bounty had the desired effect, and the wheat-growing interest became a permanent one.

The State of New-York, at the session of her Legislature of 1840-41, granted $8,000 a year, for five years, to be distributed among the several counties, for the promotion of the cause of agriculture. She also gave a bounty of fifteen cents a pound on cocoons, and fifty cents a pound on reeled silk. Connecticut gives a bounty of fifty cents a pound on reeled silk. In Massachusetts,

it is fifteen cents on cocoons and fifty cents on reeled silk. In Illinois, ten cents on cocoons, and fifty cents on reeled silk. The bounty in Pennsylvania is twenty cents on cocoons, and fifty cents on reeled silk. In Indiana, — cents on cocoons, and fifty cents on reeled silk. Bounties are paid in several other States; and in Georgia, the bounty on cocoons is *equal to their value* in market; and the State, at that, will be a great gainer, provided this induces her citizens to turn their attention to the subject. All the States are opening their eyes to the importance of the subject. Every pound of silk that is produced *in consequence* of the bounty, is so much additional wealth to the community in which it is raised. It brings into that community an amount of money equal to the value of the silk produced.

After the culture is once successfully established, the bounty will not be needed, as every man who desires to go into it can profit by the labors and the experiments of those who have preceded him, without any of the expense incurred by those by whose labors he profits.

The main objection seems to be, that it will be a taxation of the *many* for the benefit of the *few*. It is true, that for the small sum that the bounty paid out may amount to, the many are taxed; but is it for the benefit of the *few*? We cannot think the objection has any force, for the following reasons:

First: Although it proposes to tax the many, yet they benefitted by it to an amount infinitely greater than the tax. If this small tax should effect the object designed by it, to wit: to *induce* a *general* cultivation of the article, no one will deny but it will be a great benefit to the community in the *aggregate*. If it induces the culture, so that our people can produce what they consume, it will be to the State a benefit to the value of the amount consumed. Because, if we consume a million of dollars worth, instead of sending this money out from us, it is retained *among us*, and is *continued in circulation*. It then accomplishes a great *general* good. This ought to be sufficient.

But is it not a benefit to the people of the State *individually?* It *benefits all who are engaged in it*, of course; and we should bear in mind, that it is the *object* of the law to induce *all* to cultivate it. *Every man* who pays a tax may get it back again ten-fold, and at the same time benefit himself, and confer a great good upon the public.

But how is it *now?* Are not the many taxed for the benefit of the *few?* We can say what we please about extravagance, about what *might* be, and what *ought* to be; still the *fact is*, that the people of the State do consume silk fabrics to a large amount. Every tax-payer in the State, and thousands who pay no direct tax to the State whatever *tax themselves* to procure the article. *There is not a family in the State, in which there is not more or less of it consumed.* To whose pecuniary benefit is all this? Certainly not to the *consumer*, but to the *producer*. The money goes into his pocket. Where shall we find the producer? *On another continent?* The importers, the jobbers, and the retailers, are the only persons in this country who are pecuniarily benefitted by it, and they only to the limited extent of the profits they make, as it passes through their hands. The large proportion of this tax, paid by the people of the United States, goes out of the country to oil the wheels in the machinery of other governments, and to aid in cherishing other institutions, to which ours must necessarily be in direct variance. This enormous tax, it is true, is a voluntary one, but as *really* a loss to the people as though government should wring it from them, without appropriating it to their use. Thus we see, that the use of this article, which *will be used by all*, is a tax upon the *consumer* for the benefit of the *producer*. And when the consumers and producers are a different people, there is a loss to the consumer to the value of the article consumed. Now, any person can see that, if the article is *produced* in the same community in which it is *consumed*—if the producer and consumer are *one*, this loss cannot occur.

If a man produces *all* that he consumes of any article, he of course need not *pay out* any thing for the article. It is the same with communities. If the people of this State produce all that they consume of a given article, of course they need not send their money out of the State for the article. An individual raises one hundred pounds of raw silk, worth five dollars a pound. He sells it at home to the manufacturer for five hundred dollars. With this he pays his laborers, and other expenses out, and has a handsome balance for other uses. The purchaser manufactures the raw material—sells it to the merchant, by which he gets back his five hundred dollars, and the *cost* and *profit* of manufacturing it. With this he pays his workmen, all of whom distribute it among the community, for the necessaries and comforts of life.

The individual who was the producer of the raw material, with the same money that he received for it, with others who are perhaps not at all engaged in the business, buy of the merchant all that they wish for family consumption. This enables the merchant to buy again of the manufacturer, and the manufacturer to purchase the next crop of the original producer. So that we see the same money performing, over and over again, its proper functions, and is *still retained in the community*, that it may be continually used as a circulating medium in that community. How much better would this be, than the contrary state of things! Now, the money that is paid by the consumer, goes to the retailer; from him to the jobber and importer, and is by him shipped across the water, and goes into the pockets of the foreign producer. The consequence is, that it takes more money to perform the ordinary operation, for which money is used. If the article was produced, as well as consumed, among us, the money that is used as a means by which the article, in all its stages, is exchanged from one to another, could continue to be used for the same purpose, and also to facilitate other operations that require the *same* means. Now it is used but *once;* as, when it passes from the hand of the consumer, it goes *out* of the community. And to the amount that is thus carried away, other money must supply its place; or so much of the *means*, by which the ordinary commercial operations are performed, *are gone*, and the *same* operations cannot be performed. This is one great

cause of the general derangement of the business operations of the country. Too much money is sent *out* of the country. Could it be retained among us and used, as it was made to be used, general prosperity would be the certain result.—This will not be the case, until we *produce* as much as we *consume*.

The immediate object of a bounty is to induce the people to look into the subject, and to *commence* the culture. When once fairly started, the bounty will not be needed. The amount that will be paid as a bounty, will be a mere pittance at most; and for every cent so paid, one hundred fold will be returned to the pockets of the people. And as the culture progresses, *induced by this bounty*, property will rise in value, and the Treasury will be doubly replenished with the same amount of taxation.

Importation of Silk Manufactures into the United States from foreign countries, and Exports of the same, from 1821 *to* 1841, *inclusive—being* 21 *years. Prepared from official documents, expressly for this work.*

Year.	Imports.	Exports.
1821	$ 4,486,924	$1,057,233
1822	6,480,928	1,016,262
1823	6,713,771	1,512,449
1824	7,203,284	1,816,325
1825	10,271,527	2,965,442
1826	7,104,837	3,234,720
1827	6,545,245	1,690,126
1828	7,608,614	1,223,184
1829	7,048,628	920,958
1830	5,774,010	952,079
1831	10,804,393	1,041,610
1832	7,147,712	1,288,323
1833	9,300,856	1,266,416
1834	2,626,997	896,801
1835	16,597,983	765,501
1836	22,889.684	760,822
1837	15,133,064	1,207,812
1838	9,842,276	666,529
1839	21,678,086	750,916
1840	9,761,223	1,212,721
1841	15,511,009	580,756
Total,	$210,541,051	$26,827,285

Total Imports for 21 years,		$210,541,051
" Exports	do.	26,827,285
Consumption,	do.	$183,713,766
Annual Average,	do.	$8,748,274

And including the estimated consumption of Foreign Silks, for 1842 and '43, amounts for 24 years to $200,000,000

RAW SILK.

Imports and Exports of Foreign Raw Silk (included for the above) for 5 *years.*

Year.	Imports.	Exports.
1837	$211,694	$118,434
1838	29,938	79,251
1839	39,258	4,682
1840	234,235	200,239
1841	254,102	227,113
Total,	$769,227	$629,719

CHAPTER XI.

Labor applicable to the Silk Culture—For the Clergy—For Pauper Establishments—For the Shakers—For Schools.

LABOR APPLICABLE TO THE SILK CULTURE.

Having the trees and the buildings, there remains only the labor to be applied. Now in almost every farmer's family in the country, there is considerable labor, which is comparatively unavailable There are persons advanced in life, who have passed the season of severe labor. There are children, whose services might be made productive. There are young women, who cannot, or who, from filial duty or various considerations, are unwilling, to leave the paternal roof. There are many, who are averse to go out to service, and equally averse to go into a factory at a distance from home. There are many young women occupying a standing in society which, in the present condition of public manners, a condition which we cannot alter or transcend at our pleasure, necessarily shuts them out from various employments, of which otherwise they might avail themselves to aid in their own support; who are now comparatively without occupation, and whose necessary expenses it may be difficult for them and their parents to meet. Public opinion or fashion, is a despotic tyrant, whose rule is sovereign and inexorable. It must be considered likewise, that the introduction of machinery, the use of water power, and the large cotton and woolen establishments raised up in different parts of the State, have entirely destroyed what may properly be called houschold industry. Even the humble knitting-needle, is in many cases, completely displaced by machinery. We complain that the music of the spinning-wheel, and the flying of the shuttle are no longer heard in our farm houses. We cannot expect it to be otherwise. This is not because our women are not as much disposed to be as industrious as their grandmothers, but because, in truth, it would be almost folly to contend by the ancient arts against the modern processes of manufacture. Then again, for want of this opportunity of domestic labor, thousands and thousands of our young women, forsake the parental hearth, and fly in crowds to our cities, to seek employment in the various trades and arts which are there practised; and, where unprotected and removed from the restraints of parental care, amidst the dreadful perils which surround them, they but too often find the grave of their honor and virtue: to themselves, and to those, whom they leave behind, a more dreadful sacrifice than that of life. To all these descriptions of persons, the culture and reeling of silk may furnish a necessary, easy, respectable, and profitable employment. Many a small farmer in the State, without difficulty, without expensive investments, without using any but the services of his own family, and without, in any measure, interfering with or deranging his farming operations, may, under proper arrangements, produce his fifty, hundred, or two hundred pounds of raw silk per year. This, even at two and a half or three dollars per pound, a price below which it is not likely to fall, would afford a convenient and agreeable addition to his income. This seems to be entirely practicable. Here the

calculations are all closely restricted; and founded not upon conjecture, but upon actual experience and determined results. This supplies a want, which is deeply felt throughout the country; and opens views most grateful to the philanthropic mind. In Italy and France, as I am informed, the production and reeling of silk, are almost wholly conducted in this domestic way. The aggregate amount in such a case throughout the State, would be immense; and this all obtained without any expensive advances or any great risks, or any labor, but that which is now comparatively unproductive and otherwise unavailable. It may be considered in such case, as almost a clear gain; and whether it pays as well for labor, as other branches of agricultural or manufacturing pursuit or not, is of little consideration, compared with the fact, that it pays something and a reasonable compensation, where otherwise nothing would be obtained.

FOR THE CLERGY.

There is another class of persons, to whom the culture of silk would afford peculiar advantages, and prove in no way inappropriate to their condition, or inconsistent with their duties; I mean the clergy. Every intelligent person, acquainted by experience and intercourse with society in New-England, especially in its rural departments, knows what an invaluable blessing, viewed merely in a social aspect, this order of men together with the religious institutions, which rise or fall in a measure as they rise or fall, have proved to the community; and how much it is indebted to them for the good order, the good manners, and the highly improved condition which distinguish it. But that the ministry may be useful, it must be, in a degree, independent; and that, at the same time, it may retain its hold upon the community, it must not be felt to be burdensome. In the present condition of society, nothing has become more precarious than the tenure of the ministerial relation; and nothing more discouraging in the discharge of their responsible duties, than the state of depcndence upon public caprice, not to say public charity, in which they are now placed. To a truly pious and benevolent mind, it will be always grateful and delightful to dispense the gospel, as far as possible, without charge; and, if an apostle, that he might do this, served at his trade of tent-maker, a good minister will esteem it a privilege to be able, where it can be done without interfering with his professional duties and improvement, to supply, in a measure, by his own manual exertions, his own and the wants of his family. To a clergyman, then, in the retirement of the country, living upon the uncertain, scanty, and too often begrudged support, which is allowed him, what a valuable resource may the cultivation and care of the silkworm now afford. By the labor of a few weeks in a year, and then only a part of the day, he may, with the aid of an industrious family, procure by his honest exertions, a sum perhaps equal to that which his people feel able to afford; and thus obtain for himself, the means of many an innocent indulgence; perhaps too, of educating his children, and of providing for a dependent family, a comfortable subsistence in the event of his removal or death. I hope my brethren of the clergy, will not consider these suggestions as in any measure disrespectful. They are dictated by a feeling, totally opposite to this. I should be the last to recommend to them the silk culture or any other business, as matter of mere pecuniary gain, but only on the ground of a just regard for their own comfort and that of their families. A little knowledge of human nature, will convince them that their people will be always the more ready to help them, as they find them able and ready to help themselves. The clergy, from the earliest times, have been the pioneers in agricultural improvements in our country; and among a rural population, I know not how, in a secular view, a minister can render a higher service to his people, or make a stronger claim upon their respect and gratitude, than by promoting among them the study of the natural sciences, the exercise of the mechanic arts, and giving them an example of sound domestic economy, and frugal, intelligent, skilful, and improved husbandry.—There are too many such laudable examples within my own knowledge, to allow me to doubt that this may be done without in any measure interfering with his own intellectual improvement and the most conscientious, faithful, and useful discharge of his sacred duties.

FOR PAUPER ESTABLISHMENTS.

I cannot doubt likewise, that the culture of silk may be introduced with advantage into many of our pauper establishments, where farms are connected with them. Here, often, there is a great deal of light labor available, which it is difficult and impossible to apply to advantage in the common field operations of agriculture, and which, now applied to the picking of oakum or to knitting, amounts to little. This labor, under judicious superintendence, might be advantageously applied to the production of silk.

FOR THE SHAKERS.

I take particular pleasure in recommending the culture of silk to my respected friends the Shakers. They have every element of success; intelligence, skill, exactness, perseverance, abundance of labor, land enough; and buildings already prepared for their operations. They, of any among us, would be the fittest persons to undertake the artificial method of M. Camille Beauvais. Their female aid is of the best description for this culture. They may pursue it to any desirable extent; and I cannot have a doubt, if they should undertake it with their usual care and determination, their enterprise would be crowned with success.

FOR SCHOOLS.

Attempts have been made in different parts of New-England, to get up manual labor schools; that is, schools designed to aid poor young men and women in getting an education, by making their expenses light, and allowing them to defray a portion of these expenses, by some labor, rendered daily or occasionally, either in a work-shop, or a farm attached to the institution. This is a benevolent design. That it has not hitherto succeeded as well as could be wished, is not the fault of the scheme, but comes from improper management. Into such an institution, the silk culture may be introduced with singular advantage, if pains are taken previously, to have a sufficiency of food for the worms. The labor would be light,

It would occupy, excepting for two or three weeks, a small amount of time. It may be expected to yield as fair returns as any branch of agriculture, which could be connected with such an institution. It may, under some circumstances, be favorably introduced into other schools. The occupation would prove as conducive to the intellectual and moral as to the physical health. The study of nature, in all her departments, is among the most interesting and valuable of all pursuits to the young mind. Every thing that brings the young more immediately into connexion with other living beings, and especially makes demands upon their prudence, providence and kindness, becomes at once an effectual teacher of the most practical, the most valuable, and the highest virtues.

I have, as will be seen, mainly confined myself to the discussion of the silk culture in Massachusetts, and with our present knowledge of the business, and our present prices of labor. Under how much more favorable circumstances it may be pursued where slave labor abounds, where the climate admits of obtaining three or four harvests a year, and where the best trees require no care nor labor to protect them in winter, I shall leave others to determine. How well adapted this product must be to those farmers, whose situations are remote from market, and with whom the common agricultural products are too heavy to be transported, but with great loss and toil; how advantageously it might be substituted for that odious plant tobacco, which is an impoverisher of the earth as well as a poisoner of man, and which holds the miserable preëminence of standing next to that curse of curses, intoxicating drinks, it is not necessary for me to say. How much more productive it may hereafter prove than we have at present any certain grounds for calculating, will presently be determined; and I entertain the sanguine hope, under an improved cultivation, of a greatly increased yield.

If, under the circumstances which I have stated, and under the qualifications named, it can be introduced and extended in Massachusetts, not as a principal, but as a collateral and incidental branch of husbandry and domestic industry, it must prove a source of eminent comfort and wealth. That the machinery for reeling is simple and cheap, that the operation involves no mystery, and may be learned and performed by a child, are other circumstances which commend it. Massachusetts, then, I cannot but hope, will see in this case both her interest and duty. As she increases her productions and her wealth, she increases her real power; strengthens the attachments of her children to their home, and abates the desire of emigration. In introducing this article, so emphatically of domestic and household industry, she multiplies the sources of domestic comfort and competence; and affords no small nor inefficient contribution to the cause of good morals and philanthropy.

I should do injustice to my own sense of grateful duty, if I did not call the attention of my readers to the miracles of divine Providence in this wonderful animal, the silk worm; at his entrance into life, among the smallest of living existences, which come within the cognizance of our senses; in six weeks, at farthest, completing his work; and by his humble and unobtrusive labors, contributing largely to the clothing of half mankind, and creating yearly millions and millions of wealth. It would be curious to calculate the hands he fills, the mouths he feeds, the wheels he sets in motion, the ships he loads, and the vast riches to which his annual labors amount. This reads a striking lesson to the reflecting mind, on the immense results which spring from regular and combined, though minute and often a disdained labor. Nor are his changes the less extraordinary or striking to the thoughtful mind. Nature is every where full of mysterious transformations, which show that the power of death has its limits, and indicate the wonderful progress of animated existence. Having accomplished his appointed task, he wraps himself in his silken shroud, and with him death is only a transient sleep. If left to himself, he soon emerges from his tomb, no longer a reptile, but a winged chrysalis, to enjoy another existence. In the curious transformations of this humble insect, man may see an instructive indication and testimony of the progress of being; and a proof that death is not annihilation. May we, as men, exult in the hopes, gathered from such beautiful examples in nature, and confirmed by divine revelation, that with man also, death is only the threshold of life; and that for him to burst these cerements of the grave, is not like the silkworm, to pass rapidly through another form of being, but to enter upon an immortality.

CHAPTER XII.

Testimony of Frederick A. Ross, G. B Smith, and others, on Silk as a Household Product.

[If the following letters from the Rev. Mr. Ross, do not convince every reader of the practicability of the silk culture in this country, we know not what will. Those who doubt as to the *reeling* process may find a good lesson here.] Gideon B. Smith, Esq.

Dear Sir: I never felt so sanguine of the silk culture as at this moment. There is nothing now in the way of its immediate advancement in East Tennessee, unless it may be that slowness which seems inherent in the motion of a farming people to change their habits. I say there is nothing *now* in the way—because, since I recommenced reeling on the first day of this month, my success is such, that I intend to advertise to buy from one to two thousand bushels of cocoons.

The great bugbear has been the reeling. That question, as to *quality*, I considered settled by my experiments last summer, although at a costly trial. Since I have recommenced reeling, I deem the question of *quantity* disposed of forever. Presuming I should not be able to obtain cocoons for more than two reels, until the summer, I began with that number on the first day of February. My cocoons were very indifferent, with few exceptions, some not yielding more than eight ounces to the bushel—none exceeding fourteen ounces. Part of the time the weather has been very severe, filling my room with condensed steam; nevertheless, I reeled, and two hours after dark, thus showing, what was not believed,

that reeling can be done after night. Under these circumstances my average has been between nine and ten ounces for each reel per day. This reeling is better than the best average I saw on the books of the Model Filature in Philadelphia last summer. The best average I saw there, in three weeks' work, was ten and a half ounces in long summer days too, and having some, if not many, first-rate cocoons—none of which I have; and I saw no cocoons there, so bad as many of mine. I think I will show one pound per day to each reel, even with such cocoons as I have, before the 1st of March. I have reached fourteen and a half ounces. Now, my dear sir, do you not say I have some reason to be pleased? Many thanks to you for your encouragement to perseverance. The cost of my reeling is two shillings per day to each spinner, who finds herself. The flossing and turning the reel may be, *together*, one shilling more, if hired, or *nothing*, if little servants are employed. Before the 1st of March, I will show, that without counting interest on fixtures, &c., which will be a thing of nothing, I can exhibit beautifully reeled silk, which cost me two shillings per pound for reeling.

In a short time I think I shall have a very convenient filature, and silk reels enough, if I am sure of cocoons, to turn off sufficient silk to redeem the bold promise I made you last spring. I am making improvements in the saving of time, &c. every day. The double strainer to each pan I find works well.

Very respectfully,

FREDERICK A. ROSS.

Kingsport, (East Tennessee,) Feb. 23, 1841.

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[We must apologise to our friend, Mr. Ross, for the publication of both the preceding and following letter. They were not intended for publication, but they will do more public good than private harm.]

GIDEON B. SMITH, ESQ.

Dear Sir: Your esteemed favor of the 21st March, is at hand. Mr. Lynn I presume called on you, returning from Philadelphia. We think exactly alike on the subject of our national independence. And I have always, before there was any personal interest, been a Tariff man; my silk enthusiasm has hardly abated at any time in six years. It is now higher than ever. I delivered a lecture the other day twenty miles from home, in a court-house, and exhibited the model of a feeding and spinning frame, which I had carried in my saddle-bags. I enclose you an advertisement which I am spreading through this county; by which you will see that the business is no child's play with me. It is no longer experiment. I can instantly make it part of a large business operation. I want nothing but the certainty of sufficient cocoons to secure the fact of immediately converting multicaulis leaves into gold. The victory is won. The people have nothing to do but to secure it. Cocoons can be made in this county for $1 25, and, when labor is not hired, thousands will say, as a man said to my inquiry, 'what it cost to make the five bushels he sold me.' 'Cost' said he? 'Yes' said I, 'what did the produetion of these cocoons cost you?' 'O!' said he, with surprise at my question, 'they cost *nothing*, sir: my little brothers and sisters made them, and their labor would have been nothing otherwise.' If $20 had fallen from the clouds into that man's hand, he would not have had a clearer gain to his income without additional expense. Thousands will answer in this spirit, ere long, I believe.

My two reels are steadily at work. The silk reeled since 1st February amounts to about seventy pounds. Some of it as good as they can reel in Piedmont, to save their lives, (as the boys say) and the worst, many times better than any I have seen from Smyrna, or Bombay. Up to last Saturday, two girls in fifty-two days, all sorts of weather and cocoons, had reeled sixty-two pounds of silk, without their being pushed at all, and idling some of course. They are singing half their time. I hear them now. And are delighted with their work. The profit I am making at present, is greater than I expected it to be, or desire it should be. I could make more money at reeling silk, than any cotton plantation, or sugar, or gold mine in the United States. Two girls in fifty-two days have reeled sixty-two pounds of silk.

The cocoons cost me	$186 00
The two girls wages, at 2s. each per day,	36 33⅓
Two reelers, at 1s. for the two per day, (two children who turn the aspel,)	8 66⅔
Flossing cocoons, at 12½ cents to the l lb. of silk,	7 75
Total,	$238 75
Price of 62 lbs. of silk, at $5 50,	341 00
Profit,	$102 25

From which must be deducted interest on fixtures, expense of coal, water, &c. After all of which is taken off, some of which would be only nominal, there is left a greater profit than I could expect or desire on a large business. In my advertisement, you perceive I offer, conditionally, twenty per cent. more than the price now given, which, with the deduction on the cotton yarn (to the farmers as money) from the retail price, will overgo $4 on the bushel, making a pound of silk. It may be less on the inferior cocoons per ounce. I shall probably pay the equivalent to $4 per sixteen ounces, without regard to my condition, since I have read your letter.

I am fitting up my cocoonery to feed with the branches, on the principle of Mr. Morris, of Burlington, modified. I dispense with his spinning frame as he has it horizontal above each feeding frame, and have it perpendicular between the two shelves, which form one row. I have no apron or shelf to catch the litter, that may riddle through to the ground.

We talked about this, and you thought there was no need of any thing to catch the litter. The whole affair is very cheap, and I intend to give it a fair trial; my first crop will be 500,000. I kill the chrysalis (which I forgot to tell you) in a house, such as is used for drying fruit. It cost but a trifle, and in one night the work is done, and well done. I want nothing else, neither for speed, cheapness, or perfect work.

I have scribbled this in a great hurry. But being on my hobby, I have kept him going.

Mr. M. of B. says he stopped for the cold weather. I reeled when the thermometer was

nearly at zero; and two hours after night besides, every night until 1st March. I reeled my pound to the reel in the day as I promised you, and I wish I could send you one of the hanks. The cocoons were fine, and the silk is beautiful, like threads of silver, and as even and smooth as glass. That best day's work as to quantity, is not surpassed by any other in quality. And that day's work can be done any time with such cocoons, and more than that, although the average is nothing like it in quantity. The cocoons are indifferent. Very Respectfully,

FREDERICK A. ROSS.

Rotherwood, April 6, 1841.

[We must remind the reader that the girls who reeled the silk for Mr. Ross, had never seen a cocoon or a reel, till last fall; that they learned to reel, under Mr. Ross' direction, from instructions given in the Silk Journal; and to this day have never seen a foreign reeler or a thread of foreign reeled silk.—ED.]

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THE ART OF REELING SILK.

One of the greatest obstacles to the progress of the silk business in the United States has always been the supposed difficulty of reeling the cocoons. Those who have been familiar with the writings of the Editor of the Silk Journal for fifteen years past, will remember with how much pertinacity he has persisted in asserting the extreme simplicity of the art of reeling. Most persons are familiar with the fact, that many years ago an attempt was made, and proved nearly successful, in consequence of the highly respectable character of at least one of the advocates of the measure, to induce Congress to endow a school filature in Philadelphia, with $60,000, on condition of its teaching sixty young men, to be nominated by the government from the different states, in the art of reeling. The terms on which these young men were to be instructed, were, that they should attend in Philadelphia three successive summers, four months each term, find themselves in board and all other expenses, and at the end of three years, receive a certificate of proficiency. They might then return to their several residences, and institute schools for the instruction of others. The managers of the school filature were to have all the benefit of the labor of the young men in reeling, as well as the original $60,000. For several years this magnificent *project* was before Congress; it was reported favorably on by the committees of each House, and came near its consummation several times. During the whole time it was before Congress, the Editor of this Journal was engaged in opposing it, by publications illustrating the simplicity of the art of reeling, and the entire absence of any necessity for such a school. This opposition ultimately prevailed, and the attempt was abandoned; but the idea of the difficulty of the art of reeling had become so deeply impressed upon the public mind, by the memorials of the applicants, reports of committees, &c. that to this day it has been found almost impossible to efface it. Time and again have we been applied to, to send skilful reelers to this and that place, all the applicants saying they can produce the cocoons in abundance, but can make no use of them, &c. We have invariably refused to send reelers to a distance, even though they were "as plenty as blackberries," telling the applicants to *make their own reelers*, by hiring some intelligent girls, and teaching them to reel by the instructions given in the Journal. Wherever this plan has been pursued perseveringly, it has succeeded. It is now so that every person can *make his own reelers* in less time than it would take to travel from Baltimore to Tennessee, with less expense than would be required to pay their stage fare one hundred miles, and with the important advantage of the reelers thus made being always at home, and at command when wanted. Another important consideration ought not to be overlooked—the labor of *young women* instead of young men, is employed, thus giving employment to a large and valuable class of society, who, by the invention of machinery, have been deprived of their knitting needles, spinning-wheels, and of every species of employment, except the sewing needle; and the proceeds from that, so much reduced by the competition thrown upon it by the absence of other employment, that the breath of life can scarcely be drawn from it.

If no other result were to accrue from the introduction of the silk culture, than that of furnishing profitable employment to females, we should consider it of immense importance. How many thousands of females are there in the United States, incapable of maintaining themselves, and entirely dependent upon friends for support, or depending upon the precarious and stinted pittance derived from the needle? There is not a city, village, or neighborhood of twenty families in the whole Union, that does not present more or less of such females. Now if they were employed in reeling silk, the amount of good it would confer upon the country would be incalculable. First, these females would be able to earn a handsome support for themselves, and thus save that much of dead expense to the country. Second, they would be able not only to support themselves decently, but could accumulate a handsome income. Third, every pound of silk they produce would be a *ten dollar gold piece* added to the productive wealth of the country; because it would save to us the five dollar gold piece now sent abroad to purchase it, and we should have the silk also. Suppose there are twenty thousand of such females in the whole Union that might be thus employed, (and we believe there are double that number,) and suppose they reel one pound of silk per day, during eight months of the year, what would be the result to them and to the country? To them it would yield $100 a year, leaving them abundant time for improvement and recreation; whereas, now, they earn nothing. To the country it would yield four millions pounds of raw silk worth at least sixteen millions of dollars for exportation, or manufacture and consumption; and thus that amount of money, now annually exported, saved to the country, besides putting us in possession of the silk! Will not our head men turn their attention to this subject? Why will not the leading men in each neighborhood introduce the subject among their neighbors? All that is necessary to accomplish this great design, is a little persevering effort on the part of the leading men and women. We can refer to many

respectable ladies in different parts of the country that already wear *silk dresses* of their own manufacture. We can designate one in one of the most respectable families within sight of the flag on the capital at Washington, who can show a silk dress of her own production, *ab ovo*, of a quality equal to any that was ever made in France. We can show a sample of dress silk, made by a lady of the society of Friends, in North Carolina, by her own hands, from the feeding of the worms, to the weaving, coloring, and finishing, of a quality superior to any that ever crossed the Atlantic westwardly. Finally, we can refer to *ladies* in different parts of the country, and those not few in number, who only wait for proper encouragement and instruction to go and do likewise.

And after all this we shall be asked, "what is to be done, and by whom, to effect so great, so desirable a good, as the introduction of the culture of silk, and the making of silk reelers of all the females you speak of—what do you want us to do?" We answer—we want the Government to collect the proper proportion of the expenses of Government from *duties on silk*; this would serve as a small encouragement to our people to commence rearing silk worms. And then we want every influential man and woman to set the example by producing and reeling silk, that their more indigent and ignorant neighbors may see what can be done, and thus be enabled to do it. These are what are wanted, and nothing else, to save our country twenty millions of dollars annually, besides supplying us with more and better silk than we now get by sending our silver and gold to Europe to pay for it. G. B. S.

The farmer who would enjoy comfort and plenty must have more to sell than he needs to buy; indulging in luxuries only when they can be purchased by the surplus produce of the farm after his necessary wants have been supplied. That this extra supply can be secured to him by moderate industry skillfully applied, ought not to be doubted, and with it he could not fail to have means for purchasing the raw materials whenever demanded by the exercise of his skill in preparing household products.

Water power was first applied to the spinning of cotton in 1804. Prior to that time a larger part of our clothes were household manufactures. Many then thought the nation would be ruined by so serious an interruption of spinning and weaving, but the spirit of invention and enterprise which distinguish our country and the age, has originated other spheres for the exertion of skill and the display of industry in the domestic circle. And even in regard to products now much cheapened by improvements in machinery and by "division of labor," in connexion with the application of water and steam power wherever domestic industry finds no other objects to task its skill and energy, it may yet continue to move in its wonted paths, under the full conviction that every exercise of skill, and all the habits of industrious employment are in themselves sources of numerous benefits, both direct and collateral, and that the products of skill thus exerted, will be duly noticed and appreciated.

The manufacture of palm leaf hats and straw bonnets (even though steam in its wide-spread application has reached to them,) yet deserves the attention of housewives and their families; in other methods which their own ingenuity and good sense will from time to time suggest, they can show their fondness for industry. But this silk culture, in particular, opens before them an extended field for the profitable exercise of their skill and talent.

I would fain hope the time is not very far distant when this subject will receive general attention—when we shall have orchards of mulberry trees as we now have apple trees, and when our ladies will be dressed in silks of their own manufacture. It can scarcely be questioned that our soil and climate are both most propitious for the growth of the mulberry—we certainly have skill and industry equal to the enterprise of cultivating the tree, growing the worm, and manufacturing the silk. And it is hoped these will soon be regarded as necessary appendages of a well regulated farm. On this subject the ladies will give us the liberty of addressing to them a few words of special counsel. It is in our power to become a great silk growing community, and that such a consummation is exceedingly desirable cannot reasonably be doubted. But for seeing this result we must call to our aid *female influence*—the lever that is wielded with such potency for the accomplishment of benevolent and useful enterprise. To us it seems the duty and privilege of every mother in the nation to endeavor to call forth and guide the ingenuity of her daughters—giving it such a direction that it shall elevate our national character, and by diminishing our dependence on foreign nations form the independence of our own. Are the females of our country inferior in point of taste and invention to those of France? They certainly are not, though they have as certainly seemed to vie with each other in their servile dependence on French fashions and finery—to the positive injury of the nation in the consequent extravagant importations of French silks and fancy articles for their use. But would it not be far more independent, noble, and in every respect more becoming for our fair country-women to employ their leisure hours in preparing dresses from materials of domestic growth and manufacture, after patterns harmonizing with their own refined tastes, and better suited to our climate than those of the French?

Let the ladies then adopt the position that growing and reeling of silk must become a prominent object of household industry. Let them employ their influence with their husbands and brothers to procure and set out the mulberry before the next county Fair, and themselves, as soon as possible, begin the work of growing the silk. No work could be more appropriate for them than this—as it is periodical, and allows of long intervals of rest—and the reeling is an employment at once easy, social, and accordant with feminine fingers and habits.

Labor bestowed on the silk culture certainly will not be in vain, for no department of agricultural labor yields more ample remuneration than this.

ALEXANDER WALSH, *Committee.*

Mrs. Brooks, of Scituate, Mass., who claims some share in the Scituate reel, to which I have

referred,* has distinguished herself for her zeal and success in the culture of silk, in which for ten years she has been more or less engaged. She merits most justly a part of that brilliant eulogium, which the author of the book of Proverbs has pronounced upon a good woman. I do not say that she has not just claims to the whole; but it is not within my province to adjust that account. "She layeth her hands to the spindle; her hands hold the distaff. She maketh herself covering of tapestry; and her clothing is silk and purple."† Mrs. Brooks has produced and completed from the egg three full gown patterns of silk; and considerable quantities of sewings. She surprised me by saying, that if her silk cloth could be sold for one dollar per yard, taking in the whole affair of production and manufacture, she could get one dollar per day for her labor. My surprise, mingled with some incredulity, has not wholly ceased. Her veracity is beyond question; but something must be allowed for the enthusiasm with which success has inspired her; and if there be no error, yet I fear there may be a little poetry in the calculation. It is almost universal since the introduction and extraordinary improvements of manufacturing machinery, to mourn over the decline of household industry properly so called; to speak of it as we are accustomed to speak of the existence of some ancient cities—as a thing that was, but which has now become purely matter of history; what our grandmothers performed with their own hands, as only suited to point the moral of some story in a winter evening; to consider it now not the province of women to make the clothes but to wear the clothes; and like other beautiful flowers, referred to in the sacred book, with which nature is adorned, though they may array themselves in the gorgeousness of regal magnificence to regard them as no longer doomed "to toil and to spin." The eminent industry of Mrs. Brooks and Miss Rapp will do something towards redeeming the character of our own country-women from a reproach but too often cast upon them by those who seek to find an apology for their own indolence, extravagance, and want of enterprise in the imagined and magnified deficiencies and faults of others.

CHAPTER XIII.

Sixteen Experiments in Growing Silk, in the different States, as furnished by the respective individuals.

EXPERIMENT 1.—*James Dean, Greenfield, Mass.*

For a considerable period my attention has been directed to the patriotic exertions made to introduce the culture of silk into this country, but falling in with the prevailing opinions of the day, I have regarded the establishment of this important branch of agricultural pursuit as visionary and impracticable.

To satisfy myself as to the feasibility and profits of the silk culture, I have made such practical experiments in feeding worms and reeling silk, as to leave no doubts upon my mind, regarding these points. Throughout the wonderful mutations which occur in the brief existence of these precious insects, although a perfect novice, my success was complete. There is no secret, no complexity, or mystery in the art, but far otherwise. It involves but few principles, and those of great simplicity. The entire range of fundamental regulations are embraced in a sufficient allowance of space for the insects, and abundance of fodder for their consumption, a constant supply of pure air, and unremitting diligence in regard to cleanliness. In our auspicious climate, an intelligent observance of these rules will surely lead to successful results.

You are probably aware that there are two systems of rearing silk worms, the natural and artificial. The first was adopted by myself and is the one in general use, being the simplest in its details, and, therefore, the easiest in practice. It is adopted by those who engage in the culture of silk to a limited extent, or as a collateral branch of agriculture. It dispenses with the complicated preparations of a systematic course of rearing, and adapts itself to such ready means as the tenants of the soil possess. By the appropriation of a moderate space of ground for leaves, a crop of ten to fifty pounds of silk may be reeled, without essentially interfering with the farmers' legitimate plans. Through the operations of this system, the European markets are mostly supplied; the feeding season embracing but a brief portion of the year. Silk is, therefore, an integral production of the soil, a surplus commodity, which finds its way every where, and enriches the producer, for every body is the consumer.

The artificial system is conducted on strict scientific principles. Its prevailing features consist in maintaining an artificial temperature at the exact degree best adapted to develope the vital energies of the silk worm; in neutralizing the extremes of humidity and aridity; in incessant feeding by night and by day; and by observing such other regulations as best promote the health of the establishment, abridge its labors, and the while yielding the greatest amount of silk. Of course this plan is only chosen when the business is prosecuted on an extensive scale, for the cost of buildings and fixtures, the laborious service and degree of skill it demands, are very considerable. The cocooneries are fitted in a permanent style, with every appliance for pushing its little tenants through their rapid evolutions in the shortest possible period. For not only by accelerating the labors of the silk worm, do we abridge the period of its life at least one-third, but we augment its produce in a corresponding ratio. We positively obtain in twenty-four days a quantity of silk greater in amount and superior in quality than when the process is protacted through forty days; for it seems to be a law, that the nearer this precious insect is kept to a certain point of temperature, and the more assiduously its wants are supplied, the more perfect will be its developements and valuable its products. It unquestionably is so, and it would seem, therefore, that this method alone would be selected. But it must be remembered, that its application is calculated for an exclusive business, which contemplates the culture of immense numbers, and the expectation of corresponding profits. In cutting short the period of feeding we do not thereby diminish the quan-

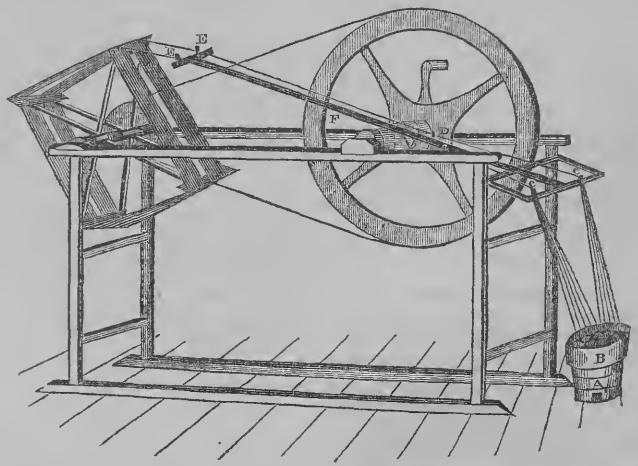
* Colman on the Agriculture of Massachusetts.
† Prov. xxxi. vs. 19, 22.

tity of forage; for, in large establishments, stimulated by the excitement of an elevated temperature, the consumption of leaves is enormous.—in the natural system, we bestow upon a brood of silk worms no more than ordinary attention to its wants; we feed them, protect them from their enemies and the vicissitudes of climate, and leave them to that unerring instinct which impels them to construct their silken spheres. When the culture of silk is merely an incidental branch of domestic industry, it is no advantage to abbreviate its labor, at the expense of other interests, and where great numbers are not involved, it would be far from repaying the extra cost. The artificial system is a beautiful result of philosophical experiment, and, under all circumstances, the more near we approximate its regulations, without incurring its expenditures, the greater will be our success.

Whether we adopt the natural or artificial methods, it is a precaution of vital consequence, that the larvæ be distributed over an area of space corresponding to their rapid growth, taking care that they never be crowded. It matters not how well all other rules are observed, if this be disregarded, they sicken in great numbers, or, at best, spin but a worthless cocoon. To promote in them the highest state of health, free space and pure air are indispensable. The atmosphere of the building must be kept pure by cleanliness and uninterrupted ventilation. When an abundant supply of leaves is superadded to these requisitions, we never hear in this climate of the loss of silk-worms by disease. This is the secret of cultivating silk, every step of which, from the first existence of the worm to the filature of its precious cocoons, is, with singular fitness, adapted to the comprehension and powers of the young, and to the infirmities of maturer age. The ingathering of leaves, the management of feeding and the filature, are performances that do not exceed the strength of childhood. In the silk districts of Europe, the insects are reared, and the silk reeled almost exclusively by women and children. In an ethical sense, it is an occupation that elevates the virtues and appeals directly to the attention of philanthropists. It is a study of nature, full of instruction, that neither hardens the heart nor corrupts the conscience, by an overreaching spirit of avarice, and it should, therefore, be the concern of our patriotism, to cherish and encourage an enterprise, that, while it administers to our happiness, does not debase the heart. Unlike the great staples of rum, sugar, and cotton, which are extorted from unwilling labor by coercion and blood, this pursuit is destined to find welcome and peaceful reception in this region of our country, which is unsurpassed in its genial condition of soil and climate, by any other on the face of the earth. If there be those who doubt the profits of this culture, a multitude of facts might be easily adduced to overthrow their scepticism and dissipate the errors they have imbibed. But there are those who will not be convinced, though one rise from the dead.

DESCRIPTION OF DEANE'S SILK REEL.

The furnace *A*.—The boiler *B*.—The filaments first pass the guides *C*, each thread by itself—they then converge and pass the guide *D* together.



Both divisions are then wound upon each sufficiently to insure firmness, roundness, and smoothness of thread, and they then separate, each one passing its appropriate guide *E*, and is then gathered upon the reel. It is spread upon the reel by a vibrating movement of the rod *F*, having its fulcrum at *a*, the alternating movement being given by a groove in the shaft of the pulley wheel at *b*. This groove receives a pin from the vibrating rod. The skeins are disengaged in the following manner: The two arms of one division of the reel are set inside of the other, and slip through a mortice in the shaft of the reel, and are retained by two keys driven at right angles with the arms. By starting these keys, the arms slip through the mortices, and the tension of the skein is at once relieved.—To lay out the groove, proceed in this wise: At one of the limits of the intended groove

stick a pin; then just half round the shaft at the other limit stick another. A straight line from one pin to the other, and back again on the opposite side, is the track for the groove.—The guides should be made of brass or German silver, by drilling a fine hole and sawing a slit to it, all made perfectly smooth. German silver neither rusts nor corrodes.

I am persuaded, sir, that silk of the finest description can be produced in New-England for two dollars and fifty cents a pound, in the first year of planting, and in the infancy of our knowledge. This estimate has been made again and again by intelligent men, and a book might be filled with reports based on actual experience, to confirm its truth. Can it be otherwise? Every variety of mulberry flourishes in our climate; and from the freedom of our atmosphere from too abundant moisture, its warmth, electricity, and purity, our country is unsurpassed for the perfection of the silkworm. It is impossible that the culture of silk will not become established on a sure basis; an event, from its enormous magnitude, of momentous concern to a nation which has been drained, in a single year, of twenty-two millions, for this article of pride and comfort alone. With such propitious advantages, with such a consumption, and with the unconquerable energy of the American people, encouraged and protected by our Legislatures, it is impossible that success will not crown this delightful pursuit.

If the art of rearing be then so easy of comprehension and practice, it is, nevertheless, exceeded in simplicity by the art of reeling the cocoon. I found that the difficulties of reeling had been exaggerated. To produce a perfect filament from the material of wool or cotton, requires the perfection of skill and machinery, but we have made to our hands a filament so perfect, that no human ingenuity can ever approach it, and all we have to do consists in laying a number of these filaments together and drawing them out by the reel, and by maintaining a uniform thread, by adding new fibres, as others become exhausted. No one need be dismayed by imaginary difficulties in reeling, for they always vanish before a spirit of determination to overcome them. All who raise silk should reel silk also. It furnishes profitable employment for young women, and by reason of the delicacy of their fingers, their ingenuity and perseverance, they will readily acquire perfection in the beautiful art that should engage their especial attention.

EXPERIMENT 2.—*J. A. Farquhar, Cincinnati, O.*

Feeling a deep interest in any thing pertaining to that all-important branch of individual and national enterprise, and having had some little practical knowledge, I felt that I was called upon, through your communication, to furnish what few facts I might be in the possession of. The first attempt I made at feeding silk worms, was in the latter part of the summer of 1840. I procured one ounce of eggs, from which, in about 30 days, I raised 102 pounds of good cocoons; the worms were fed five times a day on well chopped morus multicaulis leaves; changed often, and litter removed, until their second year, when we applied air-slacked lime once every day, and immediately preceding the last feed at night; from this time no litter was ever removed until the little (I may add abundant) crop was harvested.

The use of lime prevents any pernicious effects often produced from the fermentation of the litter; and its use at night, I am led to believe, has a very salutary effect by raising, in some degree, the temperature of the night air more upon an equality of that of the day. Not a dozen of unhealthy were among them. Upon the daily use of lime, and always feeding fresh and perfect leaves, and the room well ventilated, depends, mainly, the success of silk-growing. This crop I suffered to pierce their cocoons for the purpose of seed; such cocoons will not reel, and I am not aware that there is any machinery here to manufacture pierced cocoons.

Last spring I made arrangements to feed between one and two millions of worms: commenced about the first of June, with 8 ounces; at the approach of their 4th and last age, in consequence of the extreme drouth and want of cultivation, (the trees I hired and were to have been cultivated) our foliage failed. I had then to have recourse to an orchard, 8 miles distant from my cocoonery. Those leaves were always much wilted before feeding, and the consequence was, I did not make a half crop. The second and third crop was attended with no better success; our worms were generally healthy: none of consequence lost by sickness, except a few of the first crop. I am led to believe my failure, the past season, arose entirely for want of good, healthy, and well grown foliage. I pursued the same plan I had adopted the first season, that proved so successful, except that of the last year, a portion of which were fed upon open hurdles; all besides were fed upon shelves made of boards. I discovered no difference in the result.

We are reeling silk on the Piedmontese reel, and intend having it woven into dress silk. Want of a market for cocoons has discouraged many from going into the business of silk-growing; and want of a certainty in obtaining a supply of cocoons, I have no doubt operates to deter capitalists from entering into the manufacturing of it. A manufacturer must see, first, that there is some prospect of obtaining cocoons; and as the farmer is the proper one to look to for a supply of all the raw material, and he being generally slow to embrace new projects, some inducement, therefore, is necessary to be held out to him in shape of a bounty, and that, too, double the amount of the present. This would, with reasonable success, come near remunerating him for the trouble; this, with what he might obtain for his cocoons, would operate as a powerful stimulus, and in a very few years the act might be repealed, as the business would then fully protect itself.

There are few families among farmers who have not some members in it that cannot be of any or much service in the field, and yet could do all the work of feeding a few worms. Once embarked in it, and conducted chiefly by the female department, it would be held on to with a tenaciousness that farmers' daughters are wont to do, where they are to be so easily and amply rewarded for their labor. No country on earth is more congenial and better adapted to the growth of every variety of the mulberry, and none where the worm flourishes better. American silk is said to be of finer gloss

than that of any other country; and where will we go to find more industrious and enterprising farmers than those of the State of Ohio? No where, I believe.

N. B. I raised about 400 pounds cocoon; have no data at hand what was raised in the country.

N. B. Since the foregoing was written, I have called upon the Auditor of Hamilton county, and find the first cocoons returned to that office and the bounty claimed was in 1840, and 133¼ pounds was all. I know of many small quantities besides, which does not appear to have been returned. I find the amount returned and bounty claimed in 1841, to be 1619¼ pounds, above 1200 per cent. of an increase over the preceding year; and had the season been a favorable one, I have no doubt five times, if not ten times, the quantity would have been raised. I had, myself, calculated, at the commencement, room, &c. for above 3000 lbs.

EXPERIMENT 3.—*Ephraim Montague, Belchertown, Massachusetts.*

I have fed worms and produced silk, more or less, for six or eight years past; but not very largely until 1840. In the spring of that year, I undertook an experiment on one-fourth of an acre, for the double purpose of ascertaining the quantity of silk which might be produced from a given quantity of land; and also the amount of labor required to produce it. That experiment has been published, and may be found in the Silk Journal published in Baltimore, Jan. No., 1841; but I will give you the substance in a few words.

The last week in May, 1840, I planted three thousand roots on one-fourth of an acre, half multicaulis and the rest Cantons. The first of July hatched fifteen thousand worms. At this time the trees were very small, from 15 to 18 inches high, and I found it very slow work to pick the leaves for this crop; and the cost of labor was more than the silk was worth. The fifteen thousand worms consumed 410 lbs. of leaves, and made 35½ lbs. cocoons, which, when reeled, made but little over 2 lbs. of silk, worth $10; while the cost of labor and board, to produce it was $16. On the 28th of July and 4th of August, I hatched twenty-six thousand worms, which I fed from the same piece of land. With this crop I had much better success; the worms were quite healthy; they ate 950 lbs. of leaves, and produced 90¾ lbs. of cocoons, and yielded 7½ lbs. good silk—which, added to the first crop, make 9 lbs. and 9 ozs. of good silk from one-fourth of an acre of land, which sold at $5 the pound, besides 1½ lbs. of a poorer quality, at a less price—

Total	$51 56
To which add the State bounty on 126¾ lbs. of cocoons, at 15 cents	18 95
Also the bounty on reeling 11 lbs. silk, at 50 cents	5 50
	$76 01
From which deduct the cost of raising first crop $16, second crop $20	36 00
Leaving a net gain on one-fourth of an acre	$40 01

This, you will observe, includes the State bounty. If we leave that out it would be $15 55, or $62 20 net profit, by the acre.

In 1841, I produced, in all, over 600 lbs of cocoons, and had pretty good success, except losing some bushels of cocoons in curing with camphor, the quantity used being too small, I suppose; they came out and spoiled the cocoons. We reeled but 27 or 28 lbs.

The present season, 1842, I produced 245 lbs. of cocoons and reeled 13 lbs. of silk, although I hatched worms enough, and bestowed upon them labor enough to produce three times that quantity, had the season been favorable. But the late frosts in the spring destroyed the early feed, and the cold nights and heavy rains in August destroyed our last crop; so that the result of this year's effort has been, on the whole, rather unprofitable.

I think we need not be discouraged. Such unfavorable seasons we hope may be 'few and far between.' I think that, notwithstanding all the discouragements which the pioneers in this great enterprise met with at the outset, they have also much to encourage them, especially in the fostering hand of the Government, which is now held out to their aid, and also in the increasing confidence of the intelligent part of the community in the ultimate success of the business.

EXPERIMENT 4.—*B. B. Barton, Gill, Mass.*

I commenced keeping silkworms in the year 1840. I purchased what was considered 1 oz. of eggs, which produced 87 lbs. of cocoons, and 7½ lbs. of reeled silk. In the year 1841, I hatched what was estimated to be 3½ ozs. of eggs, which produced 249 lbs. of cocoons, and after saving 10 or 12 lbs. for eggs, reeled 21 lbs. of fine silk. The present season, I have obtained 281 lbs. of cocoons from about 4 ozs. of eggs, and have selected about 25 lbs. of the best for seed. I have not finished reeling; but should judge, from what has been reeled, that I shall obtain above 20 pounds of silk.

The worms were fed in a building used for a granary, 18 feet in length, by 14 in width, and 7 feet between the posts. I have fed two kinds of worms. The principal part were of the pea-nut variety; the remainder, of the large sulphur; and so far as my experience extends, I prefer the pea-nut. The present season I have kept two crops. The first crop commenced hatching the 17th of June. The principal part wound in thirty days. They were fed exclusively upon the foliage of the white mulberry. My usual practice was to feed five times a day, commencing early in the morning and feeding late at night. The worms were removed from their litter at each moulting, and just before they commenced winding. In the last stage they were occasionally fed upon branches. I have used various methods to enable them to wind. Some have wound upon straw, others upon the branches of sweet-fern, and some upon shelves erected expressly for that purpose, allowing none to wind in the litter, if it could be avoided. This crop produced 169 lbs. of cocoons.—With this crop no artificial heat was used, except in a few instances in the morning, when it was cool and damp.

The second crop commenced hatching on the 10th of August, and wound in about the same time as the former. They were fed entirely upon the leaves of the multicaulis. Heretofore I have used but little lime, except what was sprinkled upon the floor; and in some crops I have not used any upon the worms. But with this crop it was

used freely in the two last stages, sprinkling them daily by means of a common sieve. The worms were healthy, but not more so than former crops upon which no lime was used. The cocoons of this crop have not reeled as well as those upon which no lime was used, which induces me to believe that a free use of lime, at the time of winding, injures the reeling of cocoons. The weather in the last stage was very unfavorable, being cold and rainy most of the time, so that I was often under the necessity of drying the foliage, as I never feed with wet leaves. Artificial heat was used in the last stages, keeping the temperature between 70 and 80°—the weather being such, that without this, I am confident but few would have wound. This crop produced 112 lbs. of cocoons.

My worms have always been healthy. The first crop have always produced better cocoons than the last, which I consider owing to the fore part of the season being more favorable. From my own experience, all circumstances being the same, I believe that the leaves of the multicaulis are as conducive to the health of the silk worm as those of the white mulberry—and, in proof of this, I will state one fact: I gave a gentleman from Northfield, Mr. Morgan, about four thousand silk worms, which he fed upon multicaulis, and produced as good cocoons as any that I ever raised.

Last year I made an estimate of the expense of producing my silk, which did not exceed $60; the bounty amounted to $47 85; the silk at $5, amounted to $105. This shows that, under favorable circumstances, the present bounty will nearly defray the expense of producing it. Past seasons I have fed in the same manner as the present, with the exception that the knowledge I have gained has enabled me to keep the same number of worms with less labor and expense.—My trees grow upon a sandy soil, part of which is very light.

Thus I have endeavored to present you with a plain statement of facts, which you are at liberty to dispose of in any manner you deem proper. I believe that the rearing of silk worms in New-England is, or will be, if rightly managed, a profitable business; and, as in most parts of our country, it is yet in its infancy, it seems important to collect facts and statistical information, so that when people commence they may commence right; and then, I presume, they will make it profitable to themselves and beneficial to the country.

Experiment 5.—*T. Wheelright, Wells, Maine.*

Have fifteen hundred white mulberry trees set in a hedge, one, two, three, and four years old; cultivate the land on each side with roots. I have also one acre set last year, 4 by 8 feet, and one and a half acres set last spring, 8 by 16 feet, intending to fill up the ground hereafter. In the meantime I put in other crops. Last spring I got a few Cantons. They flourished finely, better than the Italian. The leaf 8 by 12 inches. If they stand the winter I shall multiply them by all means. Wishing to learn how to manage the worm, I began to feed as soon as I set my trees, and have fed four seasons with this result: first year 1 lb. silk; second year 6 lbs,; third year 27 lbs.; fourth year 34 lbs. Cocoons of the first crop, 240 to the lb.; second, 312 to the lb. I estimate the expense at 10 cents a pound. Trees not injured by the winter after the first year; use a building well ventilated; use no air-slacked lime; use no artificial heat. Failed in my crop this year about two-thirds, on account of the June frost.

Experiment 6.—*Robt. Sinclair, Clairmont Nursery, (near Baltimore.)*

Thy friendly letter, on the subject of the Silk Culture is before me, and would have been replied to earlier, only for my absence from home. The late frost, complained of in Massachusetts, did no injury to our mulberry trees, except in low lands. We have not been so successful the past season as we expected. We raised three successive crops, but when we examined my eggs for the fourth and fifth crops, they were all hatched out for want of ice. These mishaps we hope to guard against next season. My house is thirty-two by forty feet, two stories high, all shelved on E. Morris' plan, including the garret, which I estimate to hold four to five hundred thousand worms.—Our silk is not all reeled yet, but we shall have, say something under 75 lbs. In 1841, my crop sold for about $350; only about half of it was reeled. Both seasons the worms have been healthy. I have kept a careful account of the expense of raising the last mentioned crop of cocoons, and am well satisfied that, with proper attention of experienced hands, they can be produced for $1 per bushel [that is 10 cents a pound] after the house, trees, and eggs, are provided. The two first are a permanent investment, and the latter can be raised at a small expense.

I would advise any person about to embark in silk raising, to spend a season in some well fixed and well conducted cocoonery, or employ a person to assist who has had experience. It is like other trades—there is much to be learned. It gives me pleasure to contribute my small mite to encourage so useful, and I think profitable branch of industry in this, which may and I hope will soon be, happy country.

Experiment 7.—*B. Wells, Esq. Steubenville, O*

I let out my cocoonery and mulberry plantation on the shares. The person who undertook to feed (A. Cleawell) succeeded admirably well for the number of worms he had hatched; but owing to some misunderstanding between him and the person in whose charge I had left the eggs for safe keeping, he did not feed half as many as he could have done; he did not bring out more than two hundred thousand worms, and he had twenty bushels of cocoons, principally of the peanut variety—all first rate cocoons. He thinks he could have fed half a million in the same time. He says that all that hatched in June or July were very healthy; those that were brought out after July were somewhat sickly. He thinks the health of the worms was promoted very much by a free use of lime. And from his statement to me, I am convinced he would have lost a great part of his worms had he not used lime freely, as he suffered the filth and rubbish to remain too long without cleaning. From the little experience I have had in feeding, and from extensive information by correspondence and otherwise, I have the greatest confidence in the ultimate success of the silk culture in the United States, and,

particularly, in Ohio. Our soil and climate are well adapted, both to the culture of the mulberry and rearing the worms. I don't view it as a business for speculation. I believe it will be a moderately profitable business, with but little outlay or capital. It will add to the productive labor of the country, through a class of laborers that now have generally no employment—I mean old and feeble persons of both sexes, and children. But it is a new business with us, and our people will adventure in it cautiously—the greatest number will wait to see how the few that take hold of it will succeed. A moderate bounty upon the cocoons and reeled silk, such as many of the States give, would encourage those who are timid in the business, as it would, at least, insure them against losing by the adventure.

EXPERIMENT 8.—*John Fox, Mount Pleasant, Jefferson Co., Ohio.*

The time having nearly expired for awarding a premium of ten cents per pound, to the raisers of cocoons, and as petitions are now forwarding from various silk-raising counties in this State, praying the Legislature to renew and extend their liberality, I hope you will pardon the liberty I have taken, as an individual, in presenting a few facts that have come under my notice during the last three years, and which, I think, may have a tendency to elucidate the subject, and prove the necessity of further encouragement. Having had the honor of superintending the silk establishment belonging to John W. Gill, Esq., of Mount Pleasant, nearly three years, I have had an opportunity of witnessing the operation of the late premium. From January 1, 1840, to January 1, 1842, I have purchased for Mr. Gill three hundred and fifty bushels of cocoons, besides one hundred pounds of reeled silk, raised and reeled mostly in this State. In order to encourage the raisers of silk, Mr. Gill always instructed me to give the highest price prudence would allow; still many experienced a loss the first and second years, and had it not been for the premium most of them would have given up. You are aware, sir, that in all new adventures, practical knowledge is indispensable; this knowledge the silk raisers have to acquire by diligence and perseverance. Many went to a considerable expense in purchasing trees, but for want of judgment lost many: some the whole by frost and other casualties; others informed me the eggs they purchased were spurious: others, not knowing how to hatch the eggs and train the worms, met with great sacrifices; still they persevered, in reliance upon the future liberality of the Legislature. It is my conscientious opinion, that not more than one out of five have cleared themselves, notwithstanding the late bounty; a few individuals have been compensated, and but a few; the tree speculation is forever abandoned, and the silk trade, in all its various standings and bearings, is being fixed upon a solid basis; new raisers of silk are increasing every season in almost every county, and I have no doubt next season Ohio will be equal, if not ahead, of all the silk-growing States in the Union. I believe, sir, your petitioners do not solicit more of your liberality than has been awarded to other States, by the Legislatures of Massachusetts, Connecticut, New Jersey, Delaware, New York, Pennsylvania, Maine, &c. &c. The national advantages resulting from State bounties are obvious, if we take a retrospective view of the last three years. Look at Economy, Pennsylvania; Northampton, Massachusetts; Mansfield and Providence, Connecticut; New Jersey; Nashville, Tennessee. In Mount Pleasant, three years back, there was not the least vestige of silk weaving to be seen; now look at the silk fabrics sent to Columbus for your inspection, and if encouragement is given to the raisers and reelers, other places I am acquainted with will commence weaving next season, and in eight years will save millions, annually, of our specie being transported to foreign nations, that are looking upon us with envy and a jealous eye. Congress has kindly extended to us the arm of protection in granting a Protective Tariff, and all we now stand in need of, is the smiles and liberality of State Legislatures. It may not be amiss to notice the distribution of private capital through this State. I purchased for Mr. Gill, the last two years, cocoons and reeled silk equivalent to eight hundred bushels, which, upon an average at three dollars and fifty cents, amounts to two thousand five hundred dollars—but I have often given four dollars and four dollars twenty-five cents per bushel. This sum could never have been circulated had it not been for the late bounty, which has been like oil to the wheels of industry. It is supposed, by some persons, that American silk is inferior to foreign; this is for want of a better acquaintance with the article. I have devoted thirty-five years to the silk business in London, and nearly ten years in America, and I affirm the American silk to be not only equal, but superior (where the worms are fed upon the Italian or multicaulis trees) to any I have seen in London, from France, Italy, China, Piedmont, or Valentia. During the last twenty years in London, I had passed through my hands weekly from two hundred to two hundred and fifty pounds of silk of various kinds and qualities, so that my testimony, founded upon practice and experience, may be relied upon.

EXPERIMENT 9.—*B. B. Blakesly, Newark, Wayne Co., New-York.*

Last season fed a few worms, with indifferent success; failed for want of adequate ventilation. This spring I planted five acres of trees; have fed from one and a half acres only; have made 300 lbs. first rate cocoons, and have another brood yet to wind, sufficient, if they do well, to make 150 lbs. more. The expense of making the 300 lbs., including rents and every things, has been $42 40. Last spring I built a cocoonery, 163 by 24 feet, two stories, and finished a part for this summer's use; have the ends, sides, roof, and floors, *literally cut to pieces with windows and ventilators;* have used artificial heat, keeping the temperature up to 75°; have used air-slacked lime freely. Intend next spring to plant five acres more with trees, and hope to have foliage enough to occupy the whole of my building.

EXPERIMENT 10.—*James W. Chappell, Lima, Livingston Co., New-York.*

This is the fourth season I have been engaged in raising silk. I have fed the last season from two acres of trees. My trees are one and two

years old. The average hight is four feet. I have made 130 lbs. of cocoons the last season, and have another small crop yet to spin. The expense of making these cocoons has been $20. I use none other than multicaulis for feeding. My trees have not been essentially injured by standing out winters. I head them down in the spring. I use the 'Burlington Silk Worm Frame,' and use branches for feeding. My cocoonery is 20 feet by 60, two stories high, built expressly for the silk business. It has twenty-six glass windows, with blinds, and six large doors. It is located in a favorable situation to receive every passing breeze. I have never given my worms any artificial heat. I have used air-slacked lime freely. My efforts have been crowned with complete success, both the last season and ever since I have been engaged in the business. I convert my cocoons into raw silk on the Piedmontese reel, and intend to procure machinery for making sewing silk.

EXPERIMENT 11.—*Thomas White, Cincinnati, O.*

I am much gratified to learn that the silk business is progressing in New-England. There is nothing but a lack of practical knowledge, which prevents each State in the Union from supplying itself with all the silk needed. From the interest you manifest in the business, you will doubtless learn with pleasure that we are making a quiet, steady, and rapid progress in the West. There have been large crops of cocoons raised this season, throughout the States of Ohio, Indiana, Kentucky, and Tennessee. I have never seen a better season for raising silk in cocooneries that were constructed so that the temperature could be controlled; but in open houses it has been an unfavorable season in the West. The manufacturing of silk is keeping pace with the raising of it in the West. There will be several thousand yards of goods wove in Ohio this season, and several hundred in Indiana, by my old friend Mr. Fox, who has left Mt. Pleasant, and established a prosperous factory at Richmond, in that State. Beside these establishments, there are a large number of family machines in operation, making sewings and organzine through the four States above mentioned.—We find organzine the most profitable article we can make. It is worth $8 to $10 per lb. in the gum, which is decidedly better than making sewings. I herewith send you a small sample, made by a lady in this city, who has procured three of my machines, and is doing a very profitable business. Each machine finishes half a pound per day. For this article we have a ready cash market, at Mt. Pleasant, and Richmond, Indiana, and there will soon be another in this city.

EXPERIMENT 12.—*G. B. Smith, Esq., Baltimore.*

It would have given me great pleasure to attend your convention, and I should certainly have done so had it been in my power. Please accept of my hearty good wishes for the success of your efforts to advance the cause of silk culture in New-England, which I cannot permit myself to entertain a doubt of. New-England is emphatically the land of enterprise, industry, and perseverance, the three elements of success in every kind of business; and you must, therefore, succeed in the silk culture. If the whole country were blessed with these essential elements of prosperity, we should perhaps become too happy a people for this world—certainly, we should present to the world at large a spectacle of wealth, of happiness, and of greatness, such as has never yet been exhibited by any people. Unfortunately for the cause of silk culture in the South, this spirit is wanting; or if it exists, it is of a too fitful and hesitating a nature to succeed. Probably like the human constitution, it is debilitated by the climate! Certainly it no where, South of 'Mason and Dixon's line,' exhibits that indomitable energy and endurance, that it does at the North and East. Hence, since the explosion, or rather the evaporation of the MANIA, the silk culture has been declining in the South, till the present year, when very few persons were to be found engaged in it at all, and few of them have done much to a profit. I am sorry to be obliged to give you this melancholy picture of our Southern operations; but truth requires it. This decline in the business in this region is not attributable to any discovery of the business being impracticable or unprofitable; but rather to the depression of spirits, consequent upon the prostration of hopes in the multicaulis speculation. The people had been led to expect enormous profits in the tree trade, and when that failed, they could not endure the moderate, (though still fair) profits to be derived from making silk. Even in the silk business, they had been taught to believe they could make ten to twenty times as much as could be calculated upon in any other business, and when upon trial, only a fair living profit resulted, it was treated with contempt. But enough of this. I have not a doubt that the silk business is a profitable one, and that it will yet, sooner or later, become one of our staple interests.

The late action of Congress in establishing the Tariff will be of great benefit to the silk business. There are some defects in the Tariff, which I hope to see removed at an early day. The duty of 50 cents a pound on raw silk is too low, and does not indicate a desire to foster the raising of the raw material in this country. The duty ought to have been *one dollar a pound*, and that would have been not exceeding 25 per cent. That would not have been more than a reasonable duty, and could scarcely have been considered a protection. Still it would have been a fair encouragement to the American producer. I hope yet to see this item of the Tariff altered, as indicated. The manufacturer of silk is handsomely encouraged. His work is protected by a good duty on foreign labor, while he is enabled to import his raw material at a very low duty; thus he is favored doubly. This will also reach to the advantage of the silk grower ultimately, for it will encourage the establishment of manufactories in our own country, and then we shall have a ready market for our raw material at our doors, and this ready market and cheapness of access to it, will be equal to a heavier duty on foreign raw material. The duty of $1 50 per lb. on low priced plain silks, is also too low; because that is the very article we can and shall first make. The highest duty on fine goods is of itself moderate, even as a strictly revenue duty. Two dollars and fifty cents on a pound of the finer qualities of silk is scarcely more than twenty per cent. on their value, if as much. Twenty dol-

lars worth of the finer qualities of silk goods will scarcely weigh a pound of sixteen ounces. Sewing silk is very handsomely protected, and it is the only article of silk that can be said to be so. Still, as a whole, we have reason to be thankful for the Tariff. Although at first sight it seems to indicate a carelessness of our interests, on the part of Congress, we shall find in the end, that it will be like the judicious practice of a good physician. He does not administer stimulants to the debilitated constitution, and thus hurry it to a state of artificial excitement, but rather cautiously plies it with gentle tonics and exercise, and thus gradually raises it to the natural standard of robust health. Let us, therefore, congratulate ourselves that, if we have not got all we wanted, and as soon as we desired, we have got that which is very good now, vastly better than what we had before, and very probably that which we shall ultimately find to be all we want. Let every silk grower consider this subject in its proper light.—Let them reflect that the foreign grower of raw silk has to pay now 50 cents a pound duty, insurance, and the profits of shipping houses, on his pound of raw silk in addition to the cost of production, before he can bring it in competition with our pound of raw silk, which has none of these charges to pay. So with all other kinds of silk goods. Then may he comprehend how far the Tariff will be of benefit to him. In conclusion of this subject, I must be permitted to say, that we can now go to work with a prospect most flattering, and that if we do not now succeed, it will be because of our own want of energy and perseverance.

I made a suggestion, I believe, to the convention of silk-growers held at Northampton last year, in relation to killing the chrysalis by means of the *air pump*. This is a most interesting subject connected with the silk business, and I hope it will be taken into consideration by some practical operator, that its value or worthlessness may be established. If it prove successful, it will be a most valuable improvement. The injury done to the fibre by the old process of baking the cocoons, has caused that plan to be abandoned in this country. Steaming does not injure the fibre, but it is apt to render the reeling more difficult, by so loosening the texture of the cocoon as to cause the fibre to *tangle*. Killing the chrysalis by exposing the cocoons to the sun, is a very defective process, as its thorough effect is uncertain, and much loss is often occasioned by the moths coming out after they are supposed to be dead. Then again this process has the disadvantage of hardening the gum and thus making the reeling more difficult, as is the case in all the different processes in which heat is the agent. Killing the chrysalis with camphor, as detailed in the Silk Journal, and first suggested by Miss Rapp, of Economy, Pa., is the best and least objectionable of all the processes heretofore used. When properly applied, the camphor effectually accomplishes the object, without inflicting the slightest injury on the silk fibre, and at the same time, leaves the cocoons in the same state for reeling, that they were in before the chrysalis was killed. The cocoons reel as easily as they did when fresh spun. Still, if the air pump will answer the purpose, it is certainly better than even camphor, for it can be used without any restraint, is at all times at command, and must inevitably be effectual; for it is impossible that any insect or animal can live in a vacuum, or in any situation approaching one. We know that sealing up silk worm eggs in a bottle, thereby excluding fresh air, kills them; so it does all kinds of seeds. Then, certainly, if exclusion of fresh air will kill silk worm eggs, depriving the chrysalis of air altogether, it must also kill that, and that very speedily. This process would certainly leave the *cocoons* in precisely the same state it found them, so far as the silk fibre and facility of reeling are concerned. The *apparatus* is not expensive, and when once obtained will last any length of time. All that is required, is a large box to contain, say ten bushels, so constructed as to be air tight when closed; and an exhausting pump, or air pump, by the aid of which the air can be pumped out of the box. Any common carpenter can make the box, and I am sure any common pump maker can make the pump sufficiently perfect for the purpose. I regret very much that my health and opportunities did not permit me to make the necessary experiments during the past season, to test the merits of this newly suggested process. The experiments can be made at a trifling expense. A tight keg or barrel can be used for the box, for example, and a forcing pump of sufficient power can be made of the ordinary liquor pump used in the stores.

Experiment 13.—*John Moyer, Perry, Wayne Co., Ohio.*

Four years ago, I raised what made twenty yards of tow silk, a yard wide, and a dozen pairs of stockings; since then, I have made all into sewing silk, till 1840. I made one thousand skeins of sewing silk, and sent three pounds and fifteen ounces of raw silk to Mount Pleasant, to Mr. J. Fox and J. W. Gill, to manufacture into dress silk. We received fifteen and a half yards, after the manufacturer had taken his pay from the piece. It was worth two dollars per yard.—The silk was reeled sixteen fibres to the thread.—Mr. Fox said it ought to have been reeled only ten fibres to the thread, and it would have made handsome cloth. Of this, I will enclose you a sample, to let you see what Ohio can do. I have five acres of white mulberry trees, from five to silk years old, and five acres of multicaulis, mostly planted last year. Last season, 1841, I fed between eighty to one hundred thousand worms. The first hatching, June 3, made one hundred and fifty pounds of cocoons, the worms healthy. The second crop, only eleven days later, was not so healthy; they died in their last age, with the muscardine, though I used lime, but perhaps not enough. In all, we raised two hundred and twenty-five pounds of cocoons. We had to feed the first crop, and most of the second crop, on the white mulberry, the dry season having kept the multicaulis back very late. Last spring I built a cocoonery, forty-two by twenty feet, two stories. I expect to have foliage to feed from five hundred thousand to one million of worms next season.—Mr. G. Dulin raised nineteen pounds cocoons; and a number of others raised more or less in the county. This winter we make all into sewing silk. We have made fifteen hundred skeins, and are about half through. We sell to the merchants

at five cents per skein, which makes one dollar per ounce. Our machinery is simple, cheap, and easily made. One reel, worth four dollars, and a twisting machine, worth ten or twelve dollars, on which we can make three hundred skeins per week, worth fifteen dollars. Two females and two boys can do this.

EXPERIMENT 14.—*Ebenezer Wood, Esq., Jefferson, Ashtabula Co., Ohio.*

I have just received a letter from S. F. Taylor, Esq., a member of the House, making certain inquiries in relation to the silk business, and requesting an answer returned to you.

Feeling a deep interest (aside from all pecuniary considerations) in the culture and manufacture of silk, it is with much pleasure I comply, so far as I am able, with his requests.

In regard to our soil and climate being adapted to the growth of the mulberry I would say, that among those who have given attention to the subject for the last four or five years, I believe, there is but one opinion, and that is, both are adapted to its growth. It is said by many, whose opinions are entitled to much respect, that the whole United States is admirably adapted to its growth. But if I may be allowed to differ in opinion, I should say that Maine is too far north—not but the mulberry would grow well there, but the seasons are too short to insure profit.

The unbelief and discordant opinions about our climate and soil being adapted to the growth of the mulberry, have grown out of peculiar circumstances. In the winter of 1839, large contracts were made by speculators for mulberries, to be delivered in the succeeding fall. They were made by speculators—men who never cultivated a tree, or ever intended to. They depended, for supply, to fill their contracts, on purchases. Of course it was their interest to buy cheap. They then went at it, pen in hand, to write down the character of the mulberry, and even went so far as to employ an Englishman, a gentleman of talents, to write for them. His communications were sent to Philadelphia for publication, and from thence, together with others of the kind, spread all over the Union. Add to this, after the speculation began to decline, some of the real producers of the tree chimed in and told the same story, in order to make sale of another and new variety. Hence, have arisen most of the doubts and fears that our soil and climate are not adapted to its growth. I speak of the morus multicaulis, for I considered it well settled that we shall mostly, if not altogether, depend on that tree for silk. I have cultivated it for five years on clay and clay loam soil. At first, for the want of information, I did not succeed well, but not so now—any soil or climate which is good for Indian corn is also good for mulberry.

In regard to the effect of our climate upon the health of the worm, I have to remark that they want just such an atmosphere as we ourselves do. Give them good air, plenty of food, and occasionally a sprinkling of lime, and we may promise ourselves a good crop of cocoons. That we have good air in Ohio no one doubts; and that we have rich low land—rich in vegetable matter, going to decay, acted upon by chemical laws, generating poisonous gases, thereby producing a sickly atmosphere, will also be admitted; but all experience and science tells us, that its improvement keeps pace with that made by the axe and plough. Hence, we may look forward to a time when every section of the State will be adapted to the silk business. But how to give the worms good air is a subject on which much thought and attention has been bestowed, great improvements made, and, no doubt, much yet to be learned.

In order to insure the greatest profit, all wish to feed as many on a square foot as will answer; but how many? What should they be fed on?—whether shelves, hurdles, straw, sticks, &c., are subjects about which time and experience will teach us. There have been, as might be expected, many failures and disappointments; some have given up the business as not practicable, and of course discouraged others. Hence the necessity of legislative encouragement. But with our present knowledge and improvement, we have every reason to believe we shall realize full success; and with legislative encouragement for a few years, we believe we shall triumph over all difficulty, and add millions to the wealth of the State, and have plenty where now poverty reigns.

Here I should further remark, that I believe most of those who have given that attention to the subject the business required, have succeeded fully equal to their expectations. All, I believe, have made more or less mistakes, but they are becoming less liable to do so as we improve in knowledge on the subject. It is not to be supposed that all will succeed equally well—that is not the fact in any business.

Considering our infancy in the business, and the advances we have made, in some respect even beyond that experienced in the old world, our prospects are truly encouraging. We learn from the best authority, from gentlemen who have been to France and Italy, and taken great pains to obtain information in relation to the silk business, that in those countries it is usual for them to lose from twenty-five to fifty per cent. of their worms by disease and sickness. I have no doubt but that in a very few years it will be thought by us quite a loss to lose ten per cent. Some have succeeded so well, the past season, they tell us their loss will not exceed one per cent. My loss, I think, was about five per cent.

Thus far my remarks have been confined to the production of the raw article.

In reference to the inquiry, "whether such improvements have been made in machinery, &c. as warrant the belief that a few years more of encouragement will enable those engaged in it to compete, successfully, with the foregoing, I would answer, that I think enough has been done to warrant a beginning; and taking into consideration Yankee ingenuity and enterprize, we cannot but think it will succeed equally well with the manufacture of cotton. From 1828 to 1833, about a dozen mills for the manufacture of silk goods were erected, mostly in New England, with a view of importing the raw article until they could get a home supply. By a treaty made with France, I believe in 1833, all French goods until 1840, were admitted free of duty. This act shut down their gates, and vetoed their whole operations. It is believed that with the Tariff of 1841,

they will be able to put their machinery in motion as soon as we can give them the raw material, and that new establishments will spring up as fast as we can give them the raw article to manufacture.

As a specimen of what may be done in almost every family in the State, I send you a sample made in my family, by my daughters, said by those competant to judge, that it is equal, if not superior, to the foreign. It was reeled on a reel, in principle the same as the Piedmontese, and spun on the common wheel.

EXPERIMENT 15.—*Wm. Bebb, Esq., Hamilton, & Butler Co., Ohio.*

My attention was first directed to this subject by some specimens of sewing silk, produced and manufactured by an industrious and enterprizing society of "Shakers," residing near this place. These specimens, by their permission, I exhibited at the first fair of the Butler county Agricultural Society, held October 27, 1831, at which they received a richly merited premium. I refer to this experiment here, only because a portion of the silk was made from the native mulberry, and a portion from the *morus alba*, or white mulberry. The silk produced from the latter, was in *quantity*, *strength*, and especially in *lustre*, far superior to that produced from the former.

The little I know touching the subject of your inquiries, will, perhaps, best be told by a brief and simple narrative.

In the month of May, 1840, an agent of Messrs, Price and Son, (Long Island) called on me, and said that he had fifteen thousand morus multicaulis trees, and about three thousand composed of morus alba, morus alpine, morus eleta, &c., which would go to destruction, as he could neither sell nor give them away. I had six acres of warm black sandy loam, resting on a bed of limestone gravel, which had not been lately manured, and which had been severely cropped for forty years. This ground had been ploughed and "furrowed out," four feet apart, for Indian corn. I agreed to take the trees, plant them on this ground, and give to Prince and Son, one-third the proceeds the next autumn. I thought the experiment could not cost much, and the trees, if they could stand the climate, might be saved to the country. Accordingly, on the 10th May, 1840, we took the trees from the boxes, in good condition, and laid them lengthwise in the furrows, root and branch, as sugar cane is planted, keeping each kind separate. The weather proved favorable, and in about two weeks the multicaulis threw up roots at almost every bud, and the other varieties, shoots from their roots. The ground, during the summer, was ploughed and hoed three times, as Indian corn is cultivated. The result was, that in autumn, my lots were covered with hedge rows of mulberry trees, from five to seven feet high, numbering more than a hundred thousand; the multicaulis hanging with the most luxuriant foliage I had ever seen. The white mulberry grew about three feet high, and the morus alpine, nearly as high as the multicaulis, but fewer in number.

When the frost killed the leaves, I dug up one-third, of the whole, for Prince and Son, and buried them as farmers do potatoes. The remaining two-thirds, I resolved to leave standing in the lot unprotected, to contend for life with the ensuing winter. Dr. McFarland can describe to you the exposed aspect of the lot. Few situations, in the country, are more completely under the dominion of a "*northwester*." Winter came with its frosts, and thaws, and sleets, and storms; at one time the thermoneter hung, on a limb of a tree fully exposed, fell sixteen degrees below zero. On examination, about the first of May, 1841, I found that only the unripened wood and the tops of the trees were injured; and what is remarkable—the morus alba, morus expansa, and morus alpine, which have been considered hardy varieties, were quite as much injured, if not more, than the multicaulis. It is now December 27th, and there they stand yet, not a bud injured, the wood always ripening better the second year than the first. Messrs. Prince and Son being unable to sell their share of the trees, they directed me to *farm* them out to others as they had done to me. In this way I, last spring, distributed about thirty thousand mulberry trees among some eight or ten of the most enterprizing and industrious farmers of the vicinity, who planted them, and are now prepared to feed worms next spring. The number of multicaulis trees, in the county of Butler, at this time, cannot be less than three hundred thousand, or sufficient to feed, next summer, four millions of worms; but there will not be one-fourth that number fed.

Previous to August, 1840, I had never seen a silk worm, and knew nothing of the art of rearing them. Finding I had such a quantity of foliage, I procured one-fourth of an ounce of eggs, of the two crop worm, to experiment upon. They hatched about the third week in August, being very late, and were placed upon boards in the *garret*. They were fed on wet leaves almost entirely, for I knew no better. We gathered the leaves in the morning, while dropping with dew, to keep them fresh, and whenever they got dry, we sprinkled them with water, and I fancied the worms relished them better. Moreover, the days were hot and the nights cold, and the worms, in the garret under the roof, were almost roasted by day and chilled at night; to compensate for all this bad treatment, they had plenty of excellent leaves, and room and air. The result was, that they fed like pigs—not one in a hundred died, and about the 25th day they mounted and span fine cocoons. This variety run their course much sooner than the sulphur worms, even under the same treatment.

Encouraged by this little experiment, on three thousand worms, and finding my trees had stood the winter, I resolved, in March last, to build a small and cheap cocoonery.

It is 18 by 42 feet, of frame, not plastered, with a rough pine floor, no loft, three windows and four doors, one story high.

The windows are furnished with Venetian blinds; the whole is surmounted by a cupola five feet square, operating as a ventilator. The whole cost one hundred dollars.

Thus prepared, as soon as the leaves came fairly out, I exposed to the warm air two ounces of eggs, mammoth, sulphur, or six weeks' variety. In a few days about forty thousand worms ap-

peared, which did extremely well, and produced one hundred and thirty pounds of very heavy and excellent cocoons. Scarcely one died. We fed with multicaulis exclusively, cut no leaves, but fed first with leaves, and as the worms grew, cut branches, leaves and all—laid them upon the benches like crib work. The worms crawled along the branches and fed finely. The leaves were always fed *dry* when practicable. Scarcely one in a hundred died.

Early in July we hatched a second crop of forty thousand, which had been retarded in an ice-house. These did not do so well. The drought operating on our then sandy soil, had injured the foliage very much. The weather was too hot, and, perhaps, one-fourth died of yellows; still we had seventy pounds of cocoons of fair average quality, but far inferior to the first crop.

Experiments, rather than profit, being my object, I procured a Piedmontese reel. My wife and daughter commenced reeling, and to our high gratification, found it an easy and pleasant task. They had never seen a reel or skein of raw silk; yet they reeled, the first day, one half a pound in four or five hours. Our last year's crop amounts to two hundred pounds of cocoons from eighty thousand worms, being a pretty fair yield; about one-fourth of the whole is reeled, of which we send you a very small specimen; we would send a larger, but do not wish to encumber the mail.

We had every thing to learn last summer, and our experiments cost us more than they should have done. My profession left me little time even to direct. Most of the work was done by a German gardener, who labored in the cocoonery about half the time, and in the garden the other half. I would state the account thus:—

Silk.	*Dr.*	*Silk.*	*Cr.*
To labor	$40 40	By 20 lbs. silk, at $5	$100 00
Rent four acres	12 00	By premium from State,	20 00
Interest on Cocoonery	8 00	Total	$120 00
Reeling 20 lbs. silk	20 00	Deduct cost	80 00
Total	$80 00	Gain	$40 00

This is a very small experiment. Still it satisfies me that our farmers might make silk culture, in connection with their other business, profitable. Their children might do the work, and thus they might easily realize from one to five hundred dollars per annum, and scarcely feel the loss of time. A silk worm lives but a month, and eats but little, except the *last week* of that month.

Having thus given to you the result of my rearings, both of the mulberry tree and of the silk worm, I proceed, pursuant to your request, to add a few observations and "suggestions."

First: Silk worms want a *dry* atmosphere.—Hence, the silk of China, and of the United States, is the finest in the world. The silk regions of France and Italy are shielded by mountain ranges from sea breezes.

Second: The morus multicaulis will endure our winters. It is more easily propagated than the white mulberry, or any other variety—is equally hardy—is preferred by the worms, and makes as good, but, I think, *not better*, silk, than the *white*.

Third: The labor of producing and reeling silk may all be performed by aged persons, females and children. It is light, pleasant and healthful employment.

Fourth: The quantity of land required is very little; four acres would produce foliage enough for four hundred dollars per annum.

Fifth: Our country is now ripe for the experiment, and the next five years must decide the question, whether the mulberry trees, now happily spread over almost every county in the State, shall be preserved as a rich source of national industry and wealth, or whether they are to be utterly neglected and destroyed, as many thousands were last spring in this county.

Sixth: If we ever do become a silk producing community, all agree that we should encourage the producer of the cocoons to reel his own silk for several reasons:—1st. Cocoons reel more easily when fresh; 2d. They are a cumbrous article, easily damaged, whilst reeled silk is an extremely portable article; 3d. Since machinery, applied to manufactures, has driven the wheel and the shuttle from the farm-house, what is there left for female industry so appropriate as the reeling of silk?

EXPERIMENT 16.—*Rev. J. V. McLean, Freehold, Monmouth Co., New-Jersey.*

The weight of the silk in the case which accompanies this paper, is TWELVE POUNDS, *sixteen ounces to the pound*, and is the product of ONE QUARTER of an acre.

The soil on which my trees were grown is a heavy clay—three or four years ago, the land would not have produced 20 bushels of corn to the acre. The two previous seasons, the lot on which my experiment was made had been very moderately manured—the present season it was covered with what might be considered a good coat of marl and barn-yard manure mixed.

The 20th to the 23d of April last, I planted a half acre lot with Morus Multicaulis roots, cuttings and layers. The roots were of the previous season's growth, taken from trees that did not exceed 2½ feet. The top was cut off within two inches of the root, and the roots were laid horizontally in the row, about ten inches apart. The cuttings were from the tops of these trees, with one bud to each, and were planted six inches apart in the rows. The layers were small trees, six to eighteen inches long, and were laid continuously in the row—the root of one touching the top of another. The rows were 2½ feet apart. The length of the lot, as planted in trees, is 288 feet, and the width 75 feet. I expected to have had roots sufficient to plant half of this lot, or a quarter of an acre—they planted, however, only 26 feet in width, and 288 in length. In making out my quarter of an acre, therefore, I was obliged to include eleven feet and eight inches in width from the layers—so that the dimensions of the lot was 288 feet in length, and 37 feet 8 inches in width.

I regretted that I had not roots for the whole quarter of an acre, as the roots afforded much more leaves than the layers. Owing to close planting and the nature of the soil, the trees produced were small—say an average of three and a half feet. The present growth on the quarter of an acre does not exceed 5,500, all counted, large and small.

My cocoonery is 36 by 18 feet, 2 stories high. I fed almost entirely in the second story. There are two tiers of shelves three feet wide by twenty-

four feet long—the shelves rise one above another one foot apart, seven shelves in each tier. The second story contains 13 glass windows, with Venetian blinds. My eggs were of my own producing the previous season. They were saved with great care from my best cocoons, on muslin, the pieces of muslin rolled up in the fall, or soon after the eggs were laid, and placed in a common farm bag; and this was hung to a beam in the cellar. In March the muslins were folded up and laid one on top of another, in a small tea chest lined with lead, this was placed in another of the same kind, but a little larger; and the space between the two was filled with pulverized charcoal. Then a few thicknesses of old flannel were laid loosely over the top of the smaller chest, and a loose board laid over the larger. Then the whole was set in a still larger rough box, with a loose board on the top, and this was put down in the ice-house, so that the ice surrounded the sides of the box. In the inner tea-chest was a thermometer—the box was examined every week, and the thermometer was not allowed to rise above 45° Fahrenheit. I am thus particular as to the mode of preserving eggs, which has succeeded so well with me, because so much disappointment has been experienced in regard to eggs. Other modes equally good may doubtless be adopted for retarding the eggs—the above plan, however, succeeded with me to admiration—the last hatching, the 27th of August, was as perfect as the first.

July 18th, I hatched some two or three thousand mammoth white. July 26, five or six thousand sulphur. July 31, two or three thousand sulphur. August 19th, over 20,000 sulphur—and August 29th, hatched the last, say 5 to 8,000 sulphur. The mammoth white worms wound in 24 to 28 days—the sulphur 28 to 33 days. A few lingered to 36 or 40 days.

Green oak bushes were used for the worms to wind in. Last year I had plasterers' lathes fastened under the shelves, one and a half inches apart. I found difficulty, however, in getting the worms to ascend well. This season I used straw at first, tied up in small bundles and set on the shelves, but this did not answer as well as I had been led to expect. At length I threw every thing aside and took the oak bushes. These have succeeded with me better than any other contrivance. They seem *natural* to the worms, and I have never seen them mount any thing as readily as green bushes. The only objection I see to them is, the cocoons cannot be taken from the bushes with quite the same facility with which they may be removed from straw, or some other fixtures. A little more experience, gathered from different sections of the country, will enable us to adopt the most approved plan for winding. Of the mammoth white cocoons, it required an *average* of three hundred and seventeen to the pound, weighed just as taken from the *shelves;* of the sulphur it required three hundred. Two hundred and eighty-eight of the largest white made one pound, and of the largest sulphur, two hundred and forty-seven. The worms were fed on the shelves without hurdles, and the litter was removed from the shelves about every fourth day.—Sometimes they went from one moulting to another without having the shelves cleaned. The shelves were cleaned without hurdles, in the following manner: The attendant had a thin half inch board, planed smooth, eighteen by twenty-four inches. After the worms appeared to be through their moulting, fresh leaves were given them—the attendant took up these leaves, the worms adhering, and laid them on the board which she held in her hand, and thus removed them to clean shelves; if all did not attach to the first leaves, others were strewed on, and generally the second time going over all were removed. Many objections may be urged against hurdles. They are expensive. Hurdles to feed one million of worms will cost several hundred dollars. This expense is by no means counterbalanced by the labor which they will save, for it admits of doubt whether, after all, there is much labor saved.—The worms *will not all* ascend on the fresh hurdles, and if the policy of throwing away all that *do not ascend* readily, is adopted, probably one half the worms will be thrown away; if this is not done, leaves must be thrown on after the hurdles are removed, and the worms must be taken off as they are without the hurdles. Another objection is, the difficulty of preventing the worms from winding under the hurdles and around them, among the litter. Besides, the plan of feeding without hurdles is much more simple, and on this account to be recommended to the great mass of persons who will feed. My worms were fed as often during the day as they needed it, say five or six times; they were *never* fed at night. During the whole time of feeding, the weather was very variable, the thermometer ranged from 60 to 90 deg., with frequent easterly storms of several days' continuance; one storm lasted eight days, from August 16th to August 23d, inclusive. Several storms were accompanied with severe thunder and lightning. August 13th, a barn was struck with lightning and burnt to the ground, less than one hundred yards from the cocoonery. The worms appeared to experience no injury whatever from the thunder. The damp wet weather undoubtedly retarded them in their operations. At such times they were not so vigorous and active, but every crop was perfectly healthy; few, if any, were lost the whole season by disease. At one time my shelves were more crowded than they should have been, and worms would frequently fall to the floor. These seldom wound after they were returned to the shelves; in this way I may have lost nearly or quite the amount of one pound of reeled silk.

In order to be prepared for cold wet weather, I fitted up a furnace in my cellar, with flues leading up and around my upper room. I did not use artificial heat, however, more than a few times when the mornings were a little cool.

The whole number of worms fed on my quarter of an acre was about forty thousand. The weight of leaves which they consumed was two thousand five hundred and seventy-six pounds. The amount of cocoons produced was one hundred and thirty pounds, weighed just as taken from the shelves, without sorting or flossing. After they were sorted and flossed, there was one pound of floss, and four pounds defective cocoons, leaving one hundred and twenty-six pounds of cocoons. These produced twelve pounds of merchantable reeled silk, sixteen ounces to the pound, and one pound wastage, ends, &c. The silk was reeled on the

Piedmontese reel; the water heated in kettles, set in a furnace; one kettle was used as a heater, and the other to reel from.

From the above statement, it will be seen that it required between nineteen and twenty pounds of leaves to make one pound of cocoons. Of these cocoons, without flossing or sorting, it required ten pounds and ten ounces to make one pound of reeled silk. After they were flossed and sorted, it required ten pounds and five ounces, or about two hundred and fourteen to two hundred and fifteen pounds of leaves to make one pound of reeled silk. This shows a greater amount of leaves necessary to make one pound of cocoons, and a greater weight of cocoons necessary to make one pound of reeled silk, than the estimates published in various quarters, and greater than experiments said to have been actually required. I was often obliged to feed *wet* leaves, owing to the frequent long storms, and the worms appeared to experience no injury whatever from this. Still I did not consider it safe to feed leaves gathered in the storm, and dripping wet; and in our attempts to dry the leaves, some became wilted and were thrown away. The worms, also, were always abundantly fed, and a partial waste of leaves frequently, no doubt, occurred in this way. These things, together with the loss of perhaps the value of near one pound of reeled silk, by worms falling from the shelves, would vary the result a little, and *might* show that one hundred and ninety pounds of leaves would produce one pound of reeled silk.

I do not doubt but that under the most favorable circumstances, a few pounds of cocoons might be produced on ten or twelve pounds of leaves to the pound of cocoons. Nor do I doubt that one pound of reeled silk may be produced from eight pounds of cocoons, or even less. Much depends on the quality of the cocoons, and more on the time when they are weighed, whether in a fresh or green, or entirely dry state. I could have selected from my lot, even in a fresh state, eight pounds of cocoons, which would, beyond all question, have produced one pound of reeled silk—but this would be no test of the profits of the business.

Last year I produced at the rate of five hundred and ten pounds of cocoons to the acre—*this* year I produced at the rate of five hundred and twenty—and my deliberate opinion is, that more will fall below this standard than will exceed it; and in *one* case, where a less quantity of leaves will give the above quantity of silk, *two* cases will occur that will require a greater.

Greatly will it be for the interests of the community, if it shall be found, on farther experience, that eighty or one hundred pounds of leaves will make one pound of reeled silk, instead of two hundred and fourteen or two hundred and fifteen, as required in my experiment; for my quarter of an acre did produce two thousand five hundred and seventy-six pounds of leaves, and the trees were not stripped remarkably close either—then the amount of reeled silk per acre would be the handsome yield of one hundred and four to one hundred and twenty-eight pounds! A result I utterly despair of seeing realized.

The above shows us forty-eight pounds of reeled silk, sixteen ounces to the pound, as the product of an acre. If this is worth, as I understand it now is, $6 per pound, then the gross proceeds of an acre will be $288—the first year, let it be remembered. Or if it should be worth but $4.50 per pound, which is undoubtedly the safest price at which to rate it, the gross proceeds of an acre will then be $216.

In regard to the cost of production, it is confidently *asserted* by many, that it can be produced for $2 per pound. Mine cost me much more than this. My experience, however, satisfies me that it can be produced for $2.25 per pound, and I incline to the belief that it *may* be produced for $2. Produced on a farm in a small way, the cost will be next to nothing—the whole product will be clear gain. Now take the product of an acre as above stated, at $288, and allow this to be made at an expense of $2 per pound, you have a net profit of $192 per acre!! Allow the cost of production to be $2.25, and you still have a net profit of $180. Again—take the product at $216, (allowing the silk to be worth only $4.50 per pound) and let the cost of production be $2, it gives a net profit of $120 per acre—but allow the cost of production to be $2.25 per pound—the sum at which I know it can be made—and it still affords us a net profit of $108. This last, I am persuaded, will be found more nearly to correspond with actual results. If the price of the silk is *more* than $4.50 per pound, and the cost of production less than $2.25, so much the better for the culturist. But the above results, very nearly, are produced in another way. The amount of help necessary to attend to one acre, or to one hundred and sixty thousand worms, would not exceed the value of two females, twelve weeks each, and one male, the same time—indeed, I do not believe it would require so much help—but admitting it should, the maximum *average* value of this help would be, *here* $3 per week, including boarding—and then, the cost of producing forty-eight pounds of silk would be $108. And the value of that silk being, as above stated, $288, the net profit would be $180!! Or the value being only $4.50 per pound, or the gross amount of $216, still the net profit would be $108 per acre—exactly the result before stated—and this, let it be observed, is just $4 more than the result shown by my experiment of last year. I believe, therefore, I have demonstrated, not by *figures* and on *paper* only, but by the *actual production* of the silk, that every prudent culturist may *safely* rely on realizing a net profit of *at least* $108, the first year, or $180 while the price of raw silk continues what it now is. And I ask, is not this sufficient! ought not any reasonable man to be satisfied with this? I wish, indeed, I could have made the profits a *little* larger, but *I could not do it.*

Much is said in various quarters respecting the different varieties of mulberry trees as food for the silk worm. By some it is confidently asserted that the Multicaulis is inferior to the broad-leaved Canton, to the Broussa, and to the hundred and one other varieties for which names are invented. Others go still further, and assert that the Multicaulis is inferior to all other species, the paper mulberry alone excepted, which the worm will not eat at all; and that good silk *cannot* be made from the Multicaulis, that it is the least hardy of

all species of the mulberry, (which, however, has never been proved,) and that the quality of the silk will always be in proportion to the hardiness of the tree from which it is made.

Other species of the mulberry may be good, as I have no doubt they are; they may even be better than the Multicaulis for any thing I know to the contrary. *One thing I do know*, the worms devour the Multicaulis leaves with great avidity—grow well—continue healthy—make good silk, in sufficient quantities to yield a net profit per acre of $108 to $180. This they have done for me two years in succession. As to the quality of the silk, I do not profess to be a judge. It obtained the *gold medal*, at the fair of the American Institute in October last, and intelligent judges pronounced it superior.

Now I say other varieties of the mulberry may *make more* and *better* silk than the Multicaulis. But *has* any individual actually produced more and better silk from any other tree, from a quarter of an acre? Until this is done, the public will be slow to believe that so many intelligent men are deceived, and that the Multicaulis is good for nothing.

It is my deliberate conviction, that the Morus Multicaulis will be the prevailing tree for silk in this country, as well because it is peculiarly adapted to the silk worm, as because great expense will be saved in gathering the leaves. The same amount of foliage can be gathered from the Multicaulis, with probably *half* the expense, that it can be gathered from any other of the mulberry.

I entertain now an unwavering conviction that the silk business will *triumphantly* succeed in our country. That it promises to do more for the comfort of the indigent and dependent portion of our community, especially for indigent females, and to add more to the wealth of the nation than can now be told.

CHAPTER XIV.

Letter of A. Walsh, Esq.—Introduction—Food for the Silkworm—Natural History of the Silkworm—Preparations for the Management of Silkworms, during the operations of Hatching, Feeding and Spinning—Eggs, and Preparations for Hatching—Preparations for Feeding—Preparations for Spinning—Of Hatching and Feeding—Raising of the Worms and forming the Cocoons—Management during the Breeding Operation—Of Stifling or Killing the Chrysalis—Of Reeling—On the Production of a Succession of Crops in a Season.

LANSINGBURG, N. Y., October 16, 1843.

Messrs Greeley & Mc Elrath:—

Having understood that you were about publishing a work on the subject of the Culture of Silk, and, judging from the thorough and perfect manner in which you have heretofore disposed of the matters embraced in your numerous publications, I am anxious that the one on the important subject of Silk should be equally full and satisfactory. I therefore take the liberty of calling your attention to a "Brief System of Practical Instruction through every operation in Silk Growing," prepared by my late friend Samuel Blydenburgh, of this place, the manuscript of which was furnished by me after Mr. Blydenburgh's death, to the Editor of the Berkshire Farmer. This article forms the best Manual for Silk Growers that I have met with, and I doubt not its insertion in your contemplated "Useful Work," will prove a highly valuable acquisition.

Allow me here a word or two by way of tribute to a man of worth. Mr. Blydenburgh was a man to whom the agricultural and mechanical portions of the community are under especial obligations. He wrote extensively for agricultural and other periodicals, and his suggestions and plans were of a character so practical and well matured, that they could hardly fail to be instructive and profitable.

The value of the Silk business, viewed as a branch of useful industry, is now so far appreciated, that it is less needful than formerly to set forth its claims to general attention; but as introductory to the treatise of my friend, allow me to exhibit to your readers a few facts and considerations, by way of illustrating this topic and commending it to their increased regard. An intelligent population, prompt to avail themselves of any new sources of industry which may be opened, and which promise them an adequate remuneration for their labor, will, I am confident, give due weight to whatever may be suggested. Convince enlightened agriculturists that the culture of Silk will be attended with a handsome profit, and its general adoption must be ensured.

The statements which have recently been laid before the public on this subject, are most gratifying to those who, like myself, years ago asserted the practicability of the Silk culture; and the argument which they afford is conclusive in favor of the value and importance of this branch of industry. The experiments made in different parts of the United States form a new era in the business of Silk culture, and must remove every lurking doubt as to its practicability and utility, even when managed on an extensive scale. It will give a new impetus to such as are already engaged in the employment, and arrest the attention of others in whom the subject has hitherto awakened comparatively but little interest.

I am gratified to observe that in New England this enterprise is steadily advancing. The amount of Silk made seems to be doubling with each successive year. "Maine can grow Silk; New Hampshire and Vermont can grow Silk.—Notes of encouragement come from the cold North and the warm South. The fertile West has spoken in terms full and decided. Onward we are summoned; onward determined to move."

The late experiments and results connected with the "Silk Culture," assume especial importance when regarded in a national point of view, and as pointing to a general and lasting benefit that must flow from the successful establishment of the Silk culture and manufacture in the United States—this being "a department of industry that has enriched and aggrandized every nation by which it has been adopted."

Now that the principal obstacles in the way of the successful prosecution of this business have been surmounted, will not our agriculturists generally direct their attention to this branch of new and profitable industry? The production of Silk fabrics might furnish employment to classes of our population who are now of necessity unemployed, or meagrely compensated for their labor. This would secure the advantage of steadiness of employment—increase the average reward of labor—promote individual comfort and national wealth. I persuade myself—looking at present indications, and at the same time dwelling in my own mind on the importance of the subject—that the United States will shortly become a Silk-growing nation; that Silk will be the prime staple article, and its culture the most profitable branch of agriculture; and the time thus arrive when there will be saved to the nation the amount of money now expended in purchase of foreign Silks, and exceeding *seventeen millions of dollars* per annum.

Like all other new enterprises, this may, however, for a time encounter difficulties in forcing its way to general adoption; but by the spread of information of the results of successful experiment, and as to the best methods and processes connected in the culture and manufacture of Silk, the enterprise will increase in favor with the intelligent and public spirited population. A view of its ultimate importance will encourage many to persevere in despite of every obstacle, and the example of their success will excite emulation in others, until the business of Silk culture shall assume that position among us, to which, from its importance, it is justly entitled.

I will close this by simply adding a few reasons why I think the people of the United States, and especially the farmers, should engage in the business of silk growing:

1. Because silk forms the heaviest item in the catalogue of our importations.
2. Because we possess the means of doing it to better advantage than any other nation.
3. Because the necessary skill is equally acquired, and no nation ever possessed better talents to acquire it.
4. Because the nation is under heavy embarrassments on account of excessive importations, and no other means are so sure of success in providing the necessary relief.
5. Because it can be effectually engaged in by all classes of people, requiring little or no capital.
6. Because we have more sparc land than any other nation, and much well suited to the growth of the mulberry, which is worn out for other purposes.
7. Because we are already well stocked with the mulberry trees, which will be lost to the nation if not used for that purpose.
8. Because a stock of silk worms may be obtained the first year, equal to what could be reared of any other live stock in a great portion of a lifetime.
9. Because raw silk or cocoons are always sure of sale.
10. Because it is a very certain crop.
11. Because a pound of silk worth six dollars can be grown in less time than a pound of wool worth fifty cents.
12. Because it will cost no more to transport a pound of silk to market worth six dollars, than a pound of bread-stuff or pork worth six or eight cents.
13. Because the labor of growing a crop of silk requires only six or seven weeks, while that of almost any farming crop requires more than as many months.
14. Because most of the labor wil be performed by women, children, or invalids—who, though willing, are unable to perform other profitable labor.
15. Because there are hundreds, if not thousands, of skilful silk-manufacturers in the country who are unable to find regular employment for want of raw silk.
16. Because the growing and manufacture of silk has never failed to be a source of wealth to any nation which embarked in it.

Very respectfully, yours,

ALEXANDER WALSH.

INTRODUCTION.

The growing of Silk is one of the pleasantest rural employments, if not identically the most so, of any branch of human industry; and is also one of the most lucrative, as the produce is always sure of a market at a fair price. It is, also, a business simple in its nature, and easily understood. But, however easy it may be to acquire a sufficient understanding of it, yet that understanding is absolutely necessary; and without it, the best managed undertaking would probably end in loss and disappointment. Like every other business, however simple, it requires theory and practice. A perfect theoretic knowledge of the business of hatching, feeding and rearing Silkworms, may be clearly committed to writing, and may be read with perfect understanding; but still a practical acquaintance will be necessary to make it familiar, and consequently pleasant and successful.

The object at which we aim in this little treatise, is to present the unpractised beginner in Silk growing, such information as will lead him in safety through an experimental course. When this course is completed, the learner will have ac-

quired a familiar and interesting acquaintance with the Silk worm, and to speak figuratively, will have so far learned its language, as not only to know, but to anticipate its wants, and keep it in a vigorous and healthy state, through every period of its existence. There is, perhaps, no other living creature whose life is less precarious than the silkworm; but still, it is an insect of delicate organization, and its life depends on certain indispensable requirements. These are, an uncontaminated atmosphere, a proper temperature, and suitable and timely food. With these, its life is almost certain—without them, it will not live.

Its prolific nature and the shortness of its duration, render it more easily and speedily obtained than any other animal stock. Its profits are equal if not greater than those of any other, and its products command a surer market, with less fluctuation in price, than almost any other commodity. In addition to all these, it may be commenced and extended with so little capital as to be within the reach of all classes.

With all these considerations, there can be no doubt that to excite and awaken a general and persevering spirit of Silk growing, and to give proper instructions for its accomplishment, would be to point out the surest road to national wealth. The growing of the Silk will require diligent attention, and the reeling of it in such a manner as to insure success, will require patient perseverence, with all the stimulus of emulation. Without these, it would be very unadvisable to attempt it.

FOOD FOR THE SILKWORM.

The first step in the business of Silk growing, is to provide an adequate supply of food for the Silk worms. The leaves of the mulberry tree appear to be a specific provision of nature for that purpose. There are several varieties of the mulberry, on nearly all of which the Silk worm will readily feed and make Silk; but the preference is now decidedly and justly given to that called *morus multicaulis*, or mulberry with many stalks or stems.

This mulberry will grow on almost any ground, but a dry, sandy loam, is preferable. It should be made perfectly mellow, and kept entirely clear from weeds. The best mode of propagation is by cuttings, or short pieces cut from twigs or roots. About three or four inches is a suitable length; each piece having one bud.* The time for planting, is as soon in the spring as the frost is out of the ground. They should be set in rows a sufficient distance apart for convenience of cultivation; and about eighteen inches apart in the row. It is of no consequence in what way they are put into the ground, provided they are covered, and not too deep. They may be thrust into the ground, either slanting or upright, or may be planted and covered in the same manner as a hill of corn.† The most expeditious and convenient mode of separating the cuttings, is by a pair of pruning shears.

As the quantity of ground, and consequently the number of trees, will depend on the extent of the business contemplated, the following items will serve as the basis of all necessary calculations on the subject.

An acre of ground contains forty-three thousand five hundred and sixty square feet. If the trees are set out in rows six feet apart, and eighteen inches in the row, each tree will occupy nine feet, and an acre will contain four thousand eight hundred and forty trees. If each tree produces four pounds of leaves during the season, which they will more than do the second year, the amount will be fourteen thousand five hundred pounds of leaves. Forty pounds of leaves of the morus multicaulis will be an ample supply for one thousand worms; of course, fourteen thousand five hundred pounds of leaves will feed thirty-eight thousand three hundred worms; two thousand five hundred good cocoons will, on an average, yield a pound of silk, therefore one acre of ground will produce one hundred and fifty-three pounds of silk. To feed a million of Silk worms will require two acres and forty-eight one-hundredth parts of an acre, which will produce about four hundred pounds of Silk. These calculations are predicated on the second year's growth. Fifty per cent. may be added to the calculation for the third year, and one hundred per cent. to the fourth.

But the Silk growing business, though simple and easy when understood, yet, to render it successful and consequently profitable, requires knowledge which can only be gained by experience; and for want of that knowledge, many who engage in it with ardent hopes of success, will meet with disasters, of which they know not the cause; and, perhaps, becoming discouraged, will leave the business in disgust. It is, therefore, advisable, however the adventurer may calculate to extend the business, to commence breeding and rearing the worms upon a small scale, considering the first year as merely an introduction, or season of experiment. By so doing, the whole business will, the second year, become familiar, and afford pleasure and profit.

NATURAL HISTORY OF THE SILK WORM.

The phalena or moth, which is the natural parent of the Silk worm, is what would be called in common parlance of the country, a miller or butterfly. There are many curious and wonderful things in the structure of these little insects, which would be of deep interest to the naturalist, but which are of no importance to the Silk grower, with whom it is only necessary to distinguish the insect from any other, and to know the male from the female.

The body is about an inch long, and the tips of the largest wings, when extended, about an inch and a half apart. The color is a dingy, grayish white. It has four wings of the same color as the body. In the male, the upper surface of the superior wings are crossed by two brown bands. The wings of the female are less strongly marked by these bands. The female is larger than the male; but experience will soon teach the distinction. They are of a clumsy form, and incapable of flying.

These moths or butterflies issue from the cocoons which are kept for seed, and after discharg-

* My opinion in this is founded on much practice, and is corroborated by others of extensive practice; in particular, Mr. Gideon B. Smith, of Baltimore.

† I have known this method to succeed in an extensive planting, at least equal to any other.

ing a red, excrementitious fluid, the male goes immediately in search of a female, fluttering his wings very rapidly; and having found one, couples with her, still flapping his wings, and soon after they separate, the male dies. The female crawls about, and in the course of from twenty to thirty-six hours, commences laying, and having laid from two to four hundred eggs, she dies also. They never eat after leaving the cocoon.

The eggs, when first laid, are of a pale, yellow color; in a few days they change to a reddish grey, and after that to a light slate color. Those eggs that are impregnated, still continue yellow, and are useless. These eggs may be preserved an indefinite length of time, by keeping them in a cool situation. Indeed, it is doubtful whether any of them would ever hatch at the temperature of fifty-five degrees.

In the succeeding season, or whenever it is wished to hatch them, they should be placed in a temperature of sixty-four or sixty-five deg., and kept at that a few days. It should then be raised to about seventy-five deg., and increased two or three degrees daily till it reaches eighty-five, or even ninety or ninety-two deg. higher.

The worms, when first hatched, exhibit small black or dark brown specks, of a woolly appearance, scarcely visible to the naked eye. In four days they will have grown to about a quarter of an inch in length. About the fifth day it will cease eating, and lie in a torpid state, apparently asleep, for several hours. This is called *moulting*, and is repeated two or three times more, at each of which times the worms shed their skins. The intermediate spaces of time before, between, and after the moultings, are called ages. The first age generally continues about five days, the second four, the third six, the fourth seven, and the fifth ten days, varied, however, in different climates and by different modes of feeding different kinds of worms, and many other circumstances.

At the end of the fifth age, the worms, having attained their full growth, relax in their eating, and begin to show signs of what is called rising, by raising their heads and crawling about, as if wishing to climb. Being then furnished with twigs or other means of climbing, they ascend and spin, and wind themselves up in what is called a cocoon, which is a ball of silk, about the size and shape of a robin's egg, composed of a single thread of fine silk, wound compactly, beginning at the outside, and ending by enclosing the worm in the centre, changed from a worm to a chrysalis of a different form—having spun a continuous thread of silk, from a quarter to half a mile in length.

PREPARATIONS FOR THE MANAGEMENT OF SILK WORMS, DURING THE OPERATIONS OF HATCHING, FEEDING AND SPINNING.

In large Silk growing establishments, it will be necessary to make preparations accordingly; and there are extensive and well written works to give them instructions; but such establishments are not calculated to produce a Silk growing country. Such calculations would require more room, and often incur greater expense than generally appertains to the domestic circle; and it is to the united operations of that circle alone, we are to look for such advances in the business, as will lay the foundation of that degree of national prosperity which it is calculated to produce. In domestic operations, few instructions and few preparations are necessary, but these instructions must be attended to, and the preparations made, or the business will not succeed. The writer is confident that if the directions here given are duly followed, there will be no want of reasonable success.

EGGS, AND PREPARATIONS FOR HATCHING.

After due preparations are made respecting the trees, or rather shrubs of the morus multicaulis, which are to afford feed for the Silk worm, the next preparatory step is to procure a sufficient quantity of good eggs for the operations of the the first year. As the Silk worm generally lays about four hundred eggs, it will always be best to procure an ample supply; a few spare ones, even if they are thrown away, will be of little consequence. As the first season ought to be devoted to obtaining that practical acquaintance with the nature and operations of the Silk worm, and the modes of treating them, which are indispensable to future success, it would not be advisable to commence with more than an ounce of eggs, though the food may be prepared for a much greater quantity; as the trees will be larger and in better order, and be ready for an early commencement the second year. An ounce of eggs will contain about forty thousand.

It will not be essential to the beginner which of the varieties of Silk worm is commenced with, provided the parent stock from which they were obtained was vigorous and healthy; as when once properly initiated, he can use his discretion in selecting. There will always, however, be a slight preference in the general market for the Silk of the white worm, on account of its color.

In many parts of Europe, especially in Italy, much system is observed and preparations required in hatching, which in this country, in most cases, are wholly dispensed with. But though the spontaneous course generally pursued in this country has often been successful, yet it has sometimes failed; while with a little correct and systematic management, success will be certain, which will be better than to incur hazard on account of a little neglect.

It is highly important for the convenience of feeding, that each crop of worms, or at least considerable portion of them, should be hatched as nearly as possible at the same time. They will hatch in our summer atmosphere, without any care whatever, but they will, perhaps, be several days in doing it, and their being of different ages will make great difficulty in feeding, as some will be moulting and asleep, while others will be awake and hungry, and they will be of different sizes. This may be prevented, because the worms will never hatch so long as they are kept below the hatching temperature; and they will certainly hatch when the heat is increased to a certain degree.

For this purpose, it will be advisable in domestic operations, to appropriate a small room in the dwelling, and the smaller the better. It should have at least one window, as light is conducive to the health of the Silk worm, from the com-

mencement of the hatching to the spinning of the cocoons. All else that is necessary, preparatory to hatching, will be a small stove, a thermometer, a few boxes of thin pasteboard, six or eight inches square, with shallow sides, and a few sheets of coarse printing paper.

PREPARATIONS FOR FEEDING.

Large establishments, which have extensive cocooneries built for the purpose, are generally furnished with an expensive apparatus, consisting of frames, wicker hurdles, and many other articles which are not necessary in private families, especially at the commencement, as prudence dictates that such beginnings should be on a small, economical scale. The worms may be fed in one or more rooms of the dwelling, or in an open garret, or in a barn, or any other outbuildings, but the place or places must always be provided with the means of admitting the light, of screening the worms from the direct rays of the sun, of admitting fresh air, and of preventing a cold, damp wind from blowing on the worms. It would be a discouraging undertaking in most private families to procure wicker trays or hurdles —but experience has abundantly proved that common pine or other boards will answer the purpose equally well, except a little extra labor in attendance. The quantity of boards necessary to accommodate a given number of worms will vary a little, according to the different breeds of worms, as they differ somewhat in size, and according to the space seen fit to allow them. To give them space enough to insure the health, four hundred feet of boards for an ounce of eggs, or forty thousand worms, may be considered a fair allowance.* These boards, made into temporary shelves in their rough state, will answer the purpose; but it would save much labor in cleaning if they were jack-planed, and it would not injure them for any purpose afterwards.

Supposing the operations of feeding are to take place in a room in the dwelling sixteen feet square; procure twelve pieces of scantling, of the smallest size, (three by two inches, if it can be obtained,) a little more than six feet long. Lay down two of these pieces, and nail across them three strips of board four or five inches wide.— Proceed in the same manner with the other ten pieces of scantling, coupling each two together. Set them up in two rows, with three in each row. Connect the three in each row, by nailing narrow strips of board along near their tops, and about half-way from the bottom to the lowest of the first mentioned cross-pieces; but let these last be so oblique as to form braces. Then lay the boards upon the cross-pieces, forming three tiers of shelves in each row; the bottom shelf being four feet wide, the second three feet six inches wide, the third three feet—each shelf being three inches wider on each side than the one above it; so that if the worms drop from either of the upper shelves, they will fall on the one below. These shelves, set parallel in a fifteen or sixteen feet room, will leave sufficient space to go between and around them. If a stove and thermometer are used, the same used in the hatching room will answer.

PREPARATIONS FOR SPINNING.

When worms have attained their full growth, their next operation is to climb on something above the place of feeding, and commence spinning their cocoons. This is technically called mounting. For this purpose it will be necessary to have in readiness some convenient apparatus for their accommodation. In its natural, undomesticated state, the worms, no doubt, attached their cocoons to the twigs of trees, (probably the same from which they had eaten the leaves,) and the more these artificial accommodations resemble those provided by nature, the better. The general method in Europe is to procure twigs of oak, birch, or some other suitable tree or shrub, and either stripping off the leaves, or keeping them till dry with their leaves on; when the worms are nearly ready to mount, they are set up on the shelves or hurdles, and being a little longer than the distance between the shelves, the tops are bent over in a bracing position, and so connected or interwoven, as to form little arches or alcoves, called by Silk growers, cabins. In this country, various other plans have been adopted; and ingenuity may doubtless suggest many more. Some have substituted branches of breameon, and others a combination of laths; all of which have answered in some sort. But considerable depends on the fitness of these preparations. When the worms are ready for spinning, the sooner they can find an acceptable place to which they can attach, the larger and better will be the cocoons. The twigs, breameon, or any thing on which they can climb, will answer, provided they can find situations where they can attach the threads by which they fasten the cocoon in two or three places, with room for the cocoon between them. If they are cramped for room, two worms will often form their cocoons together, making what are called dupons, which are of inferior value.

These preparations, with some baskets in which to collect the cocoons, are about all the preparations necessary in this part of the business.

OF HATCHING AND FEEDING.

Having made all the foregoing preparations, the time to commence the operation of hatching, is as soon in spring as the unfolding buds of the mulberry show satisfactory proof of forthcoming leaves, without fail. The eggs may then be put into small paper boxes, allowing a sufficient number to each box. If the eggs have been separated from the papers on which they were laid, they may be spread in the box, the bottom being lined with white paper; or if not so separated,* the paper containing the eggs may be laid in pieces suited to the size of the box. Another method is recommended, and perhaps entitled to preference, which is to lay the eggs to be hatched

* Very many and discordant opinions have been expressed by persons eminent as Silk growers and as writers on the subject; but common sense is the only authority which need be consulted. The worms want room to move and breathe freely, which they cannot do if they are crowded one upon another. Mr. D'Homergue, who is probably the best living authority in the United States, allows one hundred worms to a square foot. This, doubtless, is as many as that space can accommodate consistently with health, when at their full size.

* In Europe, it is the practice to separate the eggs from the paper or cloth on which they were laid. In this country they are generally kept on the papers until they hatch. I have not been able to discover sufficiently to decide or or against either practice. Either will answer well.

on white paper, spread upon a clean table. It should here be noticed that too much care cannot be bestowed on this operation, as the future good or ill success of the crop depends mainly on the management of hatching.

The temperature of the room, during the first twenty-four hours, should not be below 75° nor much above it. It should then be raised about two degrees each day till it reaches 90°, when the worms will probably begin to appear. It should not be raised higher than 92°. Great care should be taken to prevent any sudden changes of temperature. A very dry atmosphere is also injurious to the hatching operation—it may be remedied by setting a vessel (say a quart bowl) of water in the room.

It has already been said that the worms fed together should be hatched as nearly as possible at the same time. This necessity arises, not only from the inconvenience of feeding worms of different ages, together, but from their moulting, and consequent sickness at different periods, there will constantly be some well and some sick at the same time.

To avoid these inconveniences, when the worms begin to hatch, lay over them some small mulberry twigs, with very tender leaves, taking care not to lay them so as to injure the young and tender worms. The worms, as fast as they hatch, will attach themselves to the leaves. When it appears that a sufficient number are on the twigs, take them up and put down fresh ones. Lay them as they are taken out, on a sheet of white paper, spread upon a sheet of pasteboard, for convenience of handling. Continue to do this through the day, and until nine or ten o'clock in the evening. Proceed in this manner till they are all or nearly hatched, keeping each day's hatching by themselves.

As soon as they are removed from the boxes, or table, by means of the twigs, spread a few tender young leaves, cut very fine, around them, upon the papers, and as fast as the worms leave the twigs, to feed on the cut leaves, remove the twigs away. The pasteboards, with the papers and worms may be kept in the hatching room, till the hatching is ended, and then removed to the shelves in the feeding room. It will perhaps be found most convenient to keep them on pasteboards till after the first moulting; the papers may then be placed on the shelves without the pasteboards.

I have already advised the beginner in silk-growing, not to extend the experimental, or first year's crop beyond an ounce of eggs. I shall now suppose that advice to have been followed, and that the ounce of eggs are now hatched, and have produced about forty thousand healthy silk-worms, which, if the foregoing directions have been strictly observed, will not fail to be the case. The business of hatching will now, of course, be changed to that of feeding. I will now, also, presume the present stock to be composed of large worms of four castes or moultings.

In this stage of the business, it will be of the highest importance to the experimental silk cultivator to bring to mind a comprehensive view of the nature and progress of the silk worm, through all its operations and changes during the season of feeding. The profits of the business depend on the number, size and goodness of the cocoons—these depend on the health, size and activity of the worms, and these, after the worms are hatched, in a healthy state, depend, almost exclusively, on careful, judicious and skilful management, in feeding, in cleanliness and a proper supply of wholesome air. In rearing other animals, it is only necessary to give a regular supply of wholesome food, increasing with their growth. But it is not so with the silk worm. It has its periodical interruptions, during which it eats nothing; and at times, during the intervals, it eats voraciously.

The table which follows will show about the quantity of leaves the worms will consume each day, which, if it answers no other purpose, will prevent the gathering of more leaves than are necessary. Each day's portion of leaves should be given at several meals, dividing so that it may last through the day and night, always observing to feed them when they appear hungry, and not giving them more than they will eat up while it is fresh.

A TABLE *exhibiting the quantity of food, by weight, necessary for the Worms from an ounce of eggs, also for* 10,000 *Worms, for each day of their lives, and for each age.*

Ages.	Days.	POUNDS OF LEAVES For 1 oz. of eggs.	For 10,000 Worms.	Total for one oz. eggs.	Total for 10,000 Worms.
		LBS. OZ.	LBS. OZ.		
FIRST AGE.	1	0.14	.04	7	1.10
	2	1.06	.06		
	3	3.00	.09		
	4	1.06	.06		
	5	.06	.02		
SECOND AGE.	6	4.08	1.02	21	7.10
	7	6.12	1.10		
	8	7.08	2.00		
	9	2.04	3.00		
THIRD AGE.	10	6.12	1.10	69	18.08
	11	21.08	6.00		
	12	22.08	6.00		
	13	12.08	3.00		
	14	6.08	1.10		
	15	0.00	0.00		
FOURTH AGE.	16	23.04	6.00	210	52.04
	17	39.00	10.00		
	18	52.08	13.00		
	19	59.04	14.00		
	20	29.04	7.08		
	21	6.12	1.12		
	22	0.00	0.00		
FIFTH AGE.	23	42.00	11.00	1281	374.00
	24	65.10	17.00		
	25	93.00	33.00		
	26	130.00	46.00		
	27	185.00	56.00		
	28	223.00	54.00		
	29	214.00	75.00		
	30	150.00	38.00		
	31	120.00	30.00		
	32	0.00	14.00		

It is not intended by the above table to establish feeding the worms by weight, though it might be quite advisable for the inexperienced culturist to do it in feeding the experimental crop; but its principal use is to give the means of ascertaining

how the quantity of leaves attainable will be adequate to sustain the contemplated stock.

The size and delicate organization of the silk worm are not calculated for long intervals between its meals. During its eating periods, it ought to be fed at least from four to six times in twenty-four hours, and it would, no doubt, amply reward the proprietor to attend to their feed through the night, as the night is not particularly a season of rest with them, and eating seems to be their sole employment.

The periods of moulting, as has already been shown in section two, will happen, with the kind of worms here spoken of, about the 5th, 9th, 15th and 23d days, varying, perhaps, a little from change of weather, and some other circumstances. To glut them with food when they refuse to eat it would be attended with waste of food, with injury to the worms, and with inconvenience from its litter. To withhold or neglect it when they need it would stint their growth, and perhaps cause disease. Many who have engaged in the business, have practiced feeding them promiscuously, as they would poultry. But though worms may be raised and silk made by this practice, yet it will doubtless cause the death of some worms, and retard the growth of others, and the loss of only ten worms in each thousand would cause a reduction of one per cent on the proceeds of the crop; and a diminution in the size of the worms would cause a loss still greater; it would be best in commencing experimentally, to pay all possible attention to instructions from those who have been most successful in the business. By following such instructions, though they may seem a little tedious, a first rate crop may be raised, with scarcely the loss of a single worm, and a familiarity acquired with the nature of the worms, which will render all seeming formality unnecessary in managing the next crop.

When they approach the moultings, and decline eating, care should be taken not to have much food left on the shelves during the torpid state. They should not then be disturbed; and when they revive, they should be fed very sparingly, and not moved for cleaning or any other purpose, until the whole, or nearly so, have awakened from torpor.

As soon as they have awakened from the first moulting, they should be removed on clean papers, which may be done by laying young twigs over them, while they are hungry, and as fast as they take hold of the twigs in sufficient numbers, take them up and place them on clean papers, at the same time brushing the shelves clean, where they lay. The same plan is to be pursued at each of the succeeding moultings.

During the whole term of feeding, the following things must be strictly observed:

1. There is, perhaps, no other animal that breathes more air in proportion to its size than the silkworm. A proportionate quantity of fresh air is therefore necessary, not only to their health but to their life; and in the same proportion is the atmosphere of the enclosure in which they are placed, rendered mephitic and unwholesome by their breathing. Their excrements, and the refuse of their food, by fermentation, have a farther tendency to vitiate the air and render it unwholesome. These circumstances render it essential to the life and health of the worms to maintain a degree of cleanliness and constant supply of wholesome, fresh air.

2. They cannot be maintained in health when crowded into too small a space. When at their full size, there should not be more than one hundred to a square foot; in all cases they should have room to move, and exercise freely, without impeding or greatly annoying one another.

3. A good degree of light is essential to their health, but they will be injured by the direct rays of the sun.

4. When they exhibit an appetite, they should never be exposed to long intervals of hunger, by day or night.

5. The worms should never be fed with wet leaves, as it will almost certainly produce sickness and death. To avoid this, always gather enough over night for one or two feeds in the morning. If then it should rain in the morning, the wet leaves can be gathered, and by first shaking them—spreading them on a clean floor, in a warm room, and turning them till they are dry. When there are signs of a speedy rain, gather a supply for two or three days. Spread them a little to prevent fermentation; if they wilt a little it will do no harm, but they must not be dried hard.

6. During the three ages the leaves, (except those on twigs and branches, used for moving the worms,) must be chopped; at first quite fine, but coarser, as the worms increase in size.

7. The young worms must be fed with tender young leaves, increasing in the age of the leaves with the age of the worms.

By a strict adherence to the above rules and the foregoing observations, the result will be, the loss of scarcely a single worm; a crop of larger and healthier worms, and larger and better cocoons, than will ever be obtained by the labor of a person inexperienced. After the first crop, the course will become familiar, the weighing of leaves may be dispensed with, if it has been adopted, and all farther nursery improvements will be suggested by experience.

RISING OF THE WORMS AND FORMING THE COCOONS.

We suppose the worms have now attained their full growth and are ready to commence their last labor, that of producing their cocoons. But the care of the attendant is not yet at an end. The insect now commences the most active and busy period of its life, which is to spin from the substance contained in its own body, a thread two or three thousand feet long. Before this can be done it must discharge from its body every particle of excrementitious matter, leaving nothing but the pure substance which composes the silk, and that of which its body is absolutely composed. During this delicate operation, though it requires no food, care is necessary to keep the air as nearly as possible at an even temperature. The slightest chilly breeze blowing upon them while spinning, checks their operation and injures the cocoon.

About the thirty-second day from hatching, the worms begin to decline eating, and crawl about, with their heads raised, as if they were wishing to emigrate to a "better country."

Their color has assumed a yellow cast, and

their bodies show a kind of transparency, much like a ripe plum. It is then time to prepare for their rising.

If the directions given in section three have been followed, the first step in the present operation will be to set up the twigs or branches for the worms to climb on. In doing which the ingenuity of the operator will be the best guide. The bottoms of the branches may set upon a shelf and the tops bent a little under the shelf above, (except on the upper shelf) and so interwoven as to form little alcoves or arches. Care should be taken to have the parts of the twigs or other matter they climb on, a little slanting, as the worms will climb easier, and they will be less liable, in discharging, as they sometimes do, in climbing, to injure those below them. This preparation should furnish places enough to accommodate every worm, as for want of such accommodations, some cocoons would be injuried and others lost.

Care must now be taken to give the worms all necessary and possible assistance in their operation; and if any appear unable or not disposed to rise, put them in a warmer place and feed them if necessary.

This spinning will generally be completed in four or five days. But the gathering the cocoons may as well be deferred until seven or eight days from the commencement of spinning. The manual operation of gathering needs no description; but the sorting of the cocoons at the same time is very essential. For this purpose, it will be necessary to have four baskets. In one, place the cocoons that are selected for breeding, handling them very gently. In another put all the double ones. In the third, put all that are hard and apparently fit for reeling. In the fourth put all that are loose, spotted, or have any essential blemish.

In selecting for breeding, take those which were the first to commence spinning. Among them, select those that are hardest, particularly at the ends, and which are a little depressed in the middle. If you have white ones, give them the preference, if they are equal in other respects. One pound of cocoons will produce about an ounce of eggs. It would also be well to pay a little attention to having an equal number of males and females. The male cocoons are generally rather smaller than the females, and are sharper at one or both ends, and are more depressed in the middle. As soon as they are taken down, the cocoons for eggs should be stripped of their floss, which would otherwise interrupt the moth of coming out.

As the chrysalis inclosed within the cocoons will perforate them and come out in a few days, as shown in section one, those cocoons intended for reeling, unless they are reeled before their coming out, must be submitted to some operation to destroy the life of the chrysalides, in order that they may be kept till a convenient season for reeling. This operation is technically called *stifling*.

MANAGEMENT DURING THE BREEDING OPERATIONS.

As success in Silk growing depends much on obtaining and preserving, by good management, an improved breed of silk worms, particular attention is due to this part of the business, for it is on the selection of the best cocoons for breeding and on the proper management of them, through all their operations, until the eggs are laid, that improvement mainly depends.

When the moths for breeding are carefully selected, having, as nearly as can be ascertained, an equal number of males and females, or rather, perhaps, a few extra males, let them be in a dry, warm place, about common summer heat. The males and females should be in separate places, because when they leave the cocoon, their bodies contain a humid, reddish substance, which ought to be discharged previous to their coupling.

When the moths, or millers, are about leaving the cocoons, the room should be darkened, leaving only light enough to distinguish the different objects, and should be continued so till the females have finished laying their eggs.

As soon as the moths come out, and have made their necessary discharge, but not till then, they should be taken carefully by the wings and put together in pairs, a male and female, in doing which, it would be well to select the most active and couple them together, for the sake of future improvement, and for the same reasons, the defective ones should be rejected and thrown away.

When the pairs have remained together five or six hours at farthest, they should be carefully separated, taking them by their wings, as it weakens the female to let them remain longer together. If there are more females than males, some of the most active may be taken after they are separated and put to those females that have no mate. When the eggs are laid, nothing farther remains to be done but to preserve them for a succeeding crop. Care will be necessary to preserve them from being eaten by mice, cockroaches, or other enemies.

There will be three qualities of eggs, which, for the sake of obtaining an improved breed, might be kept separate. 1, those of females with males from their first coupling, 2, those of females with males which had coupled with other females, 3, those of weak females which continue to drop their eggs longer than the usual time.

The place for preserving the eggs should be perfectly dry. The temperature may be any degree between freezing and 55°.

OF STIFLING OR KILLING THE CHRYSALIS.

There are three modes in common practice, of killing the chrysalis in the cocoons intended for reeling, either of which may be used as circumstances may render it convenient. The most ancient and most common, is putting them in an oven, after the bread is withdrawn.

The cocoons, in this case, should be put into flat baskets, lined loosely with coarse paper, and remain in the oven about an hour. They should not be suffered, through carelessness, to touch the oven. If the oven is too hot, it will injure the silk; if too cool, it will not kill the chrysalii. It must not be so hot as to scorch a white paper. When taken out of the oven, they will be very moist. They should then be wrapped immediately in blankets, and when entirely cool, spread them to dry.

Another mode now gaining practice, though more tedious, is safer, as not liable to injure the silk. This is, to spread them on sheets, exposed

to the sun three or four days, for three or four hours each day. They must be spread very thin, that the heat may have effect, and carefully wrapped up when taken in and kept in a warm place.

The third mode, that of killing them by *steam*, is preferable to either of the others, where it can be conveniently put in practice. It consists simply in exposing them a few minutes to the action of steam, without their coming in contact with the water. In this case, they should be wrapped in blankets and afterwards dried as in the first case.

There is still another mode, which has not yet been applied beyond the limits of experiment, which will probably at some day not very distant, supercede all others; but which, though perfectly simple, requires the aid of a little chemical knowledge to guide it into practical use.—This mode consists in placing the cocoons a sufficient length of time in a box or other tight enclosure, filled with carbonic acid gas. This, to any person with a smattering of chemistry, will need no instructions, and those who have not that knowledge, will do best to wait till they see the operation.

OF REELING.

This is the most important part of all the operations connected with the silk-growing business, for it is that which stamps the ultimate value of the article; but unfortunately, it is not like the preceding operations, a knowledge of which may be easily acquired, with very little experience. It requires quick apprehension, a keen sight and manual dexterity, matured by experience, before any thing can be effected to advantage in silk reeling.

In the silk business, as it has been conducted in the United States for seventy or eighty years, the sole object aimed at, and I might add, the only one supposed practicable in this country, was the manufacture of sewing-silk. As the operations in this were, until quite lately, confined almost exclusively to the State of Connecticut, those operations were considered a kind of pattern, which more recent adventurers in the business have implicitly followed, and sewing-silk was, of course, the *ne plus ultra* of their ambition. But the sewing silk alone, even if we could wholly supercede its importation, could never become an important source of wealth to the United States. Less than $1,000,000 worth of sewing-silk annually, would supply the United States, and not a pound of it could be sold in Europe, while we might sell more than $50,000,000 worth of raw silk to England and France, which they would gladly receive of us, if it were reeled in a workmanlike manner; and yet not a pound of our raw silk could be sold in those countries, as it is reeled at present. How important it is then, that we should acquire a correct and thorough knowledge of the art of reeling.

Before the commencement of reeling there are several things with which the inexperienced silk grower should be made acquainted.

1. The value of raw silk depends so entirely upon the reeling, that some silks reeled in Europe can be readily sold at ten to twenty dollars per pound, when the highest price for that of good common reeling, is six or seven dollars, and the the more ordinary reeling is only three or four dollars; and the best of these silks is, in its native state, no way superior to the American silk, if equal to it.

2. Eight pounds of good American cocoons, with skilful reeling, will yield a pound of silks, while an unskilful reeler will not obtain half that quantity.

3. The value of raw silk intended for the loom depends on its consisting of an even thread, and this depends on two distinct circumstances, first, that an even number of cocoons is kept running, and second that a full number of fresh cocoons are not started together, for the first running of a cocoon delivers a fibre which diminishes gradually in size to the last end, so that if a thread should be begun with six or eight cocoons, which should be all nearly of a length, the last end of the thread would hardly be as large as one fibre at the beginning. It is, therefore, of the highest importance to add fresh cocoons in such a manner as to correct, as far as possible, this natural inequality.

4. Another cause of imperfection in raw silk is, that the silk from the soft and loose cocoons is much less firm and unclastic than that of those that are hard and compact; and if both qualities are reeled together, the fibres are subject to different degrees of extension in the operation of twisting or throwing, and have therefore less strength, and the thread, by the separation of the fibres, becomes loose and uneven. This is remedied by a due assortment of cocoons and reeling each kind by itself.

It is hardly necessary to state here that before commencing the operation of reeling, a reel must be obtained; but it may be proper to observe, that if the reeling is intended to produce raw silk for the market, which is the only course which promises a profitable result to the silk-grower, except selling the cocoons, the reel made use of should possess certain qualifications. The thread after leaving the cocoons should pass a distance of at least five or six feet, before it winds on the reel, in order to partially dry it, and render the turns less liable to adhere together from the gumminess of the silk in its moist state. It must be so constructed as to spread the threads upon the reel, so that they may not lie one upon another in their wet state, which would greatly injure the silk.—It should be calculated to reel two threads at once, for it is indispensably essential, as will presently be shown, that two skeins, and neither more or less be reeled together.

Having provided an approved reel and the cocoons duly assorted, we will now proceed to give such instructions as we fondly hope will safely conduct the ingenious, patient and persevering adventurer to a pleasing and profitable result. A situation must be chosen which has a clear and unobstructed light.

In a common cooking furnace, kindle a fire of charcoal of hard wood, as it is important to continue a steady, or at least a controllable heat during the operation. On this furnace place a large and pretty deep tin or copper basin, nearly full of very clean, and what is commonly called soft water. When the water is heated nearly, but

not quite to boiling, and all things are ready to commence the operation, and having decided what number of cocoons to begin with, throw into the water a number, perhaps twice or three times the number which is to compose the two threads.* With a flat brush of broom corn, such as are used to brush clothes, press the cocoons down in the water, gently stirring and passing the ends of the brush over and among them. As soon as the gum contained in the cocoons is sufficiently softened by the heat of the water, the ends will separate and begin to show themselves, and must be collected by the brush and laid over the edge of the basin.

When a sufficient number of ends are collected to compose the two threads, they are passed through the front guide-wires, and after being wound several times round each other, are again separated and passed through the two guide-wires in the traverse bar, and thence to the reel, and fastened to one of the arms. The reel is then turned slowly and gently until it is perceived that the cocoons begun with are all in motion.—Then gradually increase to a lively speed.

If the water is sufficiently hot, and the cocoons are properly softened, the motion may be nearly as rapid as is convenient for the hand to turn. By turning too slowly, some of the fibres which would run off freely, with a lively motion, will be apt to catch, and rising to the guide wires, will cause them to break.

The strictest and most diligent attention must now be paid by the reeler, to see that the cocoons run freely, and that the same number of fibres is kept up, as the value of the silk depends more on the evenness of the thread than on any other qualification. The reeler must not wait for any cocoons to run out before beginning to add fresh ones, as the size of the thread from any given number of cocoons is constantly diminishing. To keep up, therefore, the size of threads, fresh cocoons must be added from time to time, according to the number commenced with. In reeling a thread of six cocoons, a fresh one ought to be added, as nearly as possible at every sixth part of the length of the cocoon. If this could be steadily effected, taking care also that the cocoons reeled together should be nearly of the same degree of fineness, the silk thus reeled, would readily command almost any price, while from inattention in reeling, the same silk, though looking beautifully to an unexperienced eye, may be scarcely worth any thing at all.

Great care must also be taken to keep the water at the proper temperature. If it is not sufficiently hot to soften the glutinous substance contained in the cocoon, they will catch, and rising up to the guide wires, will break the fibre; and if too hot, the gum becomes too much softened and the silk comes off in burs or small bunches, which will not only cause the silk to break, but occasions a roughness which greatly injures it. When the cocoons rise, it indicates want of heat, and it will be necessary to stop the reel till the heat increases; if it is too hot, a little cold water will regulate it.

As the reeling progresses, and the cocoons run out, fresh ones must be put in the water, from time to time, but not too many, as they would be apt in that case to remain too long in the hot water. Whenever the reeling ceases, other than the occasional stops in the operation, the cocoons must be taken out, as they would be much injured by remaining in the water.

Particular care must also be taken when the cocoons are first put into the water to stir and press them down very gently, that they may be wet alike throughout.

The silk must never be taken from the reel till it is thoroughly dry, for the different fibres may have different degrees of elasticity, or extensibility, which, if taken off wet will shrink differently, in drying, and cause a roughness, which injures the quality of the silk. To avoid this, there must be, to every reel, two sets of arms, so that when the skein or hank is complete, the arms, (or as is called by European reelers, the hasp) may be taken out and set for the skein to dry, and another set of arms put to the reel.

When the cocoons are nearly new or quite exhausted, the thin pellicle which surrounds the chrysalis will generally rise to the guide-wire, and the eye of the reeler must be constantly on the watch.

If the foregoing instructions are strictly noticed and implicitly followed, the silk reeled will be of a quality which will ensure credit to the reeler, and satisfaction to the purchaser, and will never fail to command a very high price.

The hanks should all contain an uniform length of thread, and when taken from the reel, they should be banded, and prepared for sale in the neatest manner possible, and labelled, expressing the quality and quantity of silk, and the number of cocoons of which the thread consists.

ON THE PRODUCTION OF A SUCCESSION OF CROPS IN A SEASON.

Nature appears to have provided every living creature with a constitution suited to its condition, and the eggs of the silk worm, being designed to perpetuate its species by producing a succeeding generation the next year, were, no doubt, in its native state, deposited on the leaves of the mulberry, or other tree, exposed to all the vicissitudes of winter. Reason therefore dictates, and experience confirms it, that they are not calculated to hatch the same season they are laid.

Whenever it is intended to produce a succession of crops, a stock of eggs, hatched the season before, sufficient for the whole succession contemplated, should be procured. They should be kept in a dry place, in a temperature not above 55°. When it is ascertained the stock of food will be sufficient for the intended crops, the next item in the arrangement will be to calculate the extent of shelves. Suppose it is wished to raise 50,000 worms. To accommodate them, allowing 100 worms to the square foot, (and more ought not to be allowed) will require 100 feet of boards.

If a person of limited means and accommodations, but being able to procure food for 50,000 worms through the season, will divide the stock of eggs into five parcels, sufficient to hatch 10,000 worms each, and procure 160 feet of shelves, the whole stock of eggs may be hatched and fed with

* It would be best to select as nearly as possible, those of equal fineness, and they must be divested of all their floss.

ample accommodation in the space of seventy-five days by the following arrangement :

Divide the 160 feet of shelves into three parts, the first containing 10 feet, the second 50, and the third 100 feet. Hatch one of the lots of worms and place them to feed on the space number 1, containing 10 feet. This will afford abundant room during the first and second ages, or till after the second moulting. This will occupy about nine days. On the tenth day, or immediately after they have finished the second moulting, remove them from space number 1 to number 2.

About six or seven days after this hatch another lot of worms, and place them on number 1. The lot on number 2 will have completed their fourth moulting in about 15 days from the removal, and may now be removed to number 3, containing 100 feet. In about fifteen days more the worms on number 3 will have finished their cocoons, and the shelves being cleared, the worms on number 2 will take their place, and the third hatching will be removed to number 2.

Proceeding in the same manner a fresh crop may be hatched every fifteen days throughout the season, and the space and accommodation which would be sufficient for any given number of worms, may thus be made to afford ample accommodations for five times the number. It will not only make those who have but little room, and have not the means of hiring help, to do five times the business they could otherwise do, but will economise with the food for the worms in nearly the same ratio, by taking advantage of the growth of the leaves throughout the season, instead of stripping them all at once.

THE END.